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mathemRACT (MAX. 250 WORDS)

Materials are intended for use by both enriched and accelerated mathematics courses. Textbooks and supplementary texts for the course are given. The course of study is divided into four broad units for each of the semesters: Semester I- lines, angles, number systems; polygons common and decimal fractions; percentage; and measurements, graphs, rations; Semester II- applied geometry, polyhedrons, sets, equations, inequalities, general numbers; and applied percentage and review money, interest, insurance, taxes. Topics, objectives, suggestions, films and film strips available, evaluation techniques, supplementary references and vocabulary to be developed and stressed are given for each concept to be developed. A supplementary vocabulary list is arranged in alphabetical order for easier location. Sample worksheets are shown. A list of useful free or inexpensive aids to mathematics teaching is given, suggested equipment is listed alphabetically, and diagrams of mathematics rooms are shown.

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TEACHERS' GUIDE

Seventh Grade Mathematics
for the Academically Talented

Issued by
E. E. HOLT
Superintendent of Public Instruction

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U. S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
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TEACHERS' GUIDE

Seventh Grade Mathematics for the Academically Talented

STATE BOARD OF EDUCATION
OHIO

Prepared by
CLEVELAND PUBLIC SCHOOLS
Division of Mathematics
In Cooperation with
THE OHIO DEPARTMENT OF EDUCATION
Under the Direction of
R. A. HORN
Director, Division of Special Education
Columbus, Ohio
1963

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Mr. James A. Clement, Coordinator

Miss Mary T. Gavin, Carl F. Shuler Junior High School

Miss E. Jean Thom, Wilbur Wright Junior High School

To each of these people, we offer our sincere thanks and appreciation. We feel that through their efforts a valuable addition has been made in the enrichment and acceleration of junior high school mathematics in Ohio.

THOMAS M. STEPHENS
Administrative Assistant
Division of Special Education

R. A. HORN
Director
Division of Special Education

FOREWORD

During the past three years, the Cleveland Public Schools in cooperation with the Ohio Department of Education have conducted a demonstration project in junior high school mathematics. This demonstration project has been supported by funds that were appropriated through legislative action.

This junior high school mathematics program was designed to augment the horizontal enrichment of the mathematics courses with vertical acceleration of course content. The teachers' guides were developed for the seventh, eighth, and ninth grade mathematics courses by the teachers and supervisors participating in the project.

This teachers' guide is an outgrowth of that demonstration project and is presented to the educators of Ohio as part of our continued efforts to provide for the school children of Ohio. It is my hope that the schools of Ohio will be able to modify or adopt this guide to meet their needs in the area of mathematics.

E. E. HOLT
Superintendent of Public Instruction

INTRODUCTION

Background

In September, 1960, the Cleveland Public Schools in cooperation with the Ohio Department of Education, Division of Special Education began a demonstration project in junior high school mathematics for academically talented students. This mathematics demonstration project was designed to go beyond homogeneous grouping and classroom enrichment. An accelerated program was begun in the seventh grade by combining the seventh and eighth grade programs into one year. Algebra I and II was introduced to these academically talented students in the eighth grade, and a combined plane and solid geometry course was introduced in the ninth grade. By accelerating the academically talented students in the junior high school, the opportunity to take an additional three semesters of college preparatory mathematics would be available to these students in the high school.

After three years, the Cleveland Public Schools have had an opportunity to evaluate the program both objectively and subjectively. The objective evaluation has been done through the use of various standardized tests given to the accelerates, the best regular classes at each grade level, and the regular classes at each grade level. In almost all cases the accelerates scored as well as or better than the groups with which they were compared on the standardized tests. It should be remembered that the accelerated students are at least six months to one and one-half years younger chronologically than the comparison groups in the regular curriculum.

A subjective evaluation was made by questioning administrators, counselors, teachers, and pupils. The general concensus of opinion of these people was that the program has been highly successful and should remain a part of the junior high school curriculum, however it should be sufficiently flexible to meet the changing needs of the school and the pupils involved.

Suggestions for Using the Guide

This teachers' guide contains materials for both enriched and accelerated mathematics courses. The materials are presented in such a way that they can be easily adapted or modified to meet the needs of most mathematics classes. The suggestions and supplementary references found in each unit should be a valuable aid to the mathematics teacher, in a regular or accelerated class.

The film and filmstrips are coded for the Cleveland Public School system, but the titles should be useful to the teacher who is seeking audio-visual materials in conjunction with a particular unit plan. Some of the evaluative materials are copyrighted tests of the Cleveland Public Schools, but much of the evaluation is a function of the individual teacher or can be adapted from tests found in the basal and supplementary text books.

It is our hope that this guide can be adapted or modified to meet the needs of both the experienced and inexperienced teacher and thereby lead to the improvement of the secondary school mathematics program.

ARTHUR R. GIBSON
Education Specialist
Programs for the Gifted

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Seventh Grade Mathematics

Tentative Course Outline
For the Academically Talented

Textbooks:

Morton, Robert Lee et al. *Making Sure of Arithmetic, 7*. Morristown, N. J.: Silver Burdett Company, 1958.

Morton, Robert Lee et al. *Making Sure of Arithmetic, 8*. Morristown, N. J.: Silver Burdett Company, 1958.

Supplementary Texts:

Brown, John A. et al. *Mathematics First Course*. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1960.

Brown, John A. et al. *Mathematics Second Course*. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1960.

Rosskopf, Myron F. et al. *Modern Mathematics, Book 1*. Morristown, N. J.: Silver Burdett Company, 1961.

Rosskopf, Myron F. et al. *Modern Mathematics, Book 2*. Morristown, N. J.: Silver Burdett Company, 1961.

School Mathematics Study Group. *Mathematics for Junior High School*. Volume I, Part 1. Yale University, 1959.

School Mathematics Study Group. *Mathematics for Junior High School*. Volume I, Part 2. Yale University, 1959.

School Mathematics Study Group. *Mathematics for Junior High School*. Volume II, Part 1. Yale University, 1959.

University of Maryland Mathematics Project. *Mathematics for the Junior High School*. First Book. University of Maryland, College Park, Maryland, 1959.

SEMESTER I

Unit I	Lines, Angles, Number Systems	6 Weeks
Unit II	Polygons, Common and Decimal Fractions	6 Weeks
Unit III	Percentage	4 Weeks
Unit IV	Measurements, Graphs, Ratios	2 Weeks

SEMESTER II

Unit I	Applied Geometry Proportion, Scale Drawing, Indirect Measurement, Square Root, Right Triangle Rule	4 Weeks
Unit II	Polyhedrons	5 Weeks
Unit III	Sets, Equations, Inequalities, General Numbers	5 Weeks
Unit IV	Applied Percentage and Review Money, Interest, Insurance, Taxes	4 Weeks

FIRST SEMESTER - Making Sure of Arithmetic, 7

Unit I - Lines, Angles, Number Systems (6 Weeks)

TOPICS	OBJECTIVES	SUGGESTIONS
Points and lines p. 268 Kinds: Straight Curved	To develop an appreciation of the structure as well as the beauty and importance of geometry To develop a meaningful vocabulary	Every pupil should make a project or compile a notebook on the geometry unit. Include these facts: Only one straight line can be drawn through two points. An unlimited number of lines can be drawn through one point. A straight line is the shortest distance between two points in a plane.
Relationships: Parallel Perpendicular Intersecting	To develop an understanding of relationship between: 1. points and lines 2. lines and lines	Using compass and straightedge construct: a. Line bisector b. Perpendicular bisector to a given point on a given line c. Perpendicular bisector from an outside point to a line Strings to illustrate kinds of lines Magazine illustrations Picture frames Venetian blinds Flooring Railroad tracks Parallel ruler Music staff lines Intersection of two main streets Curve stitching
Symmetry	To develop the ability to understand and appreciate symmetry and balance	Illustrate symmetry by using: Butterflies Leaves Folded paper--ink blots Wall paper designs Animals Famous churches and other buildings

FILMS AND FILM STRIPS	EVALUATION	SUPPLEMENTARY REFERENCES	VOCABULARY
11P12 Geometry in Art 11P1 Introduction 11P2 Vocabulary, Part I 11P3 Lines and Angles Part II 11P4 Line Relationships "Parallel Lines"	Test on: constructions spelling True, False Matching	"An Adventure in Geometry" --Ravielli pp. 10-41 "Mathematics First Course" --Brown, et al pp. 19-30 "Modern Mathematics, Book 1" --Rosskopf, et al pp. 160-163, 175 SMSG, Vol. I, Part 1 pp. 119-167 UMMaP, First Book pp. 145-156	Intuitive Geometry point line straight line straightedge curved line oblique horizontal vertical parallel transversal perpendicular intersecting intersection construction bisect bisector symmetry

Unit I - Lines, Angles, Number Systems

TOPICS	OBJECTIVES	SUGGESTIONS
Linear Scale Measurement pp. 269, 270 162-165	To develop the concept of measurement To develop the ability to use a scale	Prepare lesson on English system and metric system of measurement. Have committee prepare display of linear measuring devices. Have report on Bureau of Standards. Discuss error in measurement. Precision Tolerance Scale for each pupil Fifty foot tape Yard stick Meter stick Johannsen blocks Calipers Micrometers See Brown and Sharpe Mfg. Co. posters. Posters on Measurement from Ford Motor Co.

FILMS AND FILM STRIPS	EVALUATION	SUPPLEMENTARY REFERENCES	VOCABULARY
8H4 History of Linear Measure 4U6 Advancing in Linear Measurement "Measurement" "Steel Rule"	Worksheet on measuring of line segments prepared by teacher or pupils	"The Amazing Story of Measurement" --Lufkin Rule Co. "The Giant Golden Book of Mathematics" --Adler pp. 14, 15 "How Long Is a Rod?" --Ford Motor Co. "Making Sure of Arithmetic, 8" pp. 36-40 "Modern Mathematics, Book 1" --Rosskopf, et al pp. 209-220 227-230 "Modern Mathematics, Book 2" --Rosskopf, et al pp. 149-153 158-159 SMSG, Vol. I, Part 1 pp. 281-283 UMMaP, First Book pp. 291-296 303-306 UMMaP, Teacher's Guide, 1 pp. 227-231	line segment linear measure English system of measure inch foot yard rod mile metric system of measure millimeter centimeter meter precision tolerance standard unit error of measurement

TOPICS	OBJECTIVES	SUGGESTIONS
Angles pp. 281-285	To develop an understanding of the concept of angle	Using compass and straightedge a. Copy angles b. Bisect angles
Classification: Acute Right Obtuse Straight Reflex	To develop the ability to properly classify, measure, and construct angles	Blackboard compass and protractor Folding fan Clocks Straightedge Carpenter's rule Scissors Dowel rods Sundial Mathematics Wheel from Milton Bradley Co.
Labeling, reading, and measuring angles		
Inequalities	To recognize and use the symbols of inequality and equality	Comparison of angles Examples: Acute angle < Right angle Reflex angle > Straight angle

FILMS AND FILM STRIPS	EVALUATION	SUPPLEMENTARY REFERENCES	VOCABULARY
13L11 Angular Measurement "Angles"	Tests on construction and recognition of angles	"An Adventure in Geometry" --Ravielli pp. 23-25 "The Giant Golden Book of Mathematics" --Adler pp. 22, 23 "Making Sure of Arithmetic, 8" pp. 317-319 "Mathematics First Course" --Brown, et al pp. 31-44 "Modern Mathematics, Book 1" --Rosskopf, et al pp. 314-332 SMSG, Vol. I, Part 1 pp. 154, 155 323-334 SMSG, Vol. I, Part 2 pp. 469-489 UMMaP, First Book pp. 228-235	angle ∠ ray protractor degree ° vertex sides acute right obtuse straight reflex vertical complementary supplementary adjacent central angles arc bisect bisector
Film Strip-of-the-Month Club 355 Lexington Avenue New York 17, New York (Has available strip entitled "Equations and Inequalities")	True, False Completion	SFEMP, Booklet 1 pp. 11, 12 "Supplementary Units in Contemporary Arithmetic and Elementary Algebra" --Stein pp. 32S-34S	is equal to = is not equal to ≠ is greater than > is not greater than ≯ is less than < is not less than ≮

Unit I - Lines, Angles, Number Systems

TOPICS	OBJECTIVES	SUGGESTIONS
Reinforcement of Whole Numbers pp. 1-67	To develop an understanding of place value	Differentiation of "number" and "numeral" Polynomial expression: Example: $432 = (4 \times 100) + (3 \times 10) + (2 \times 1)$
Place value pp. 2-4		Various devices to illustrate place value: Abacus Electric abacus Number board Desk calculator Flannel board
Reading and Writing of Large Numbers pp. 5, 6		Group digits in the numerals into sets of three called periods.
"Rounding off Numbers" pp. 8, 9		Comparison of large numbers Books on science and astronomy Items from newspapers and magazines in which large numbers appear
Operations with Whole Numbers pp. 10-67	To develop accuracy in fundamental processes	Report on ways that adding, multiplying, and dividing were done in olden times.

FILMS AND FILM STRIPS	EVALUATION	SUPPLEMENTARY REFERENCES	VOCABULARY
"How Man Learned to Count" "Story of Our Number System"	Quick quizzes Attainment Tests 1, 2, 3, 4 pp. 395-398 Supplementary exercises 2, 3, 4 pp. 397-399 Unit Test 1	"Developing Mathematical Understandings in the Upper Grades" --Brueckner, et al pp. 128-173 "Mathematics First Course" --Brown, et al pp. 45-90 101-154 "Modern Mathematics, Book 2" --Rosskopf, et al p. 2 "Number Principles and Patterns" --Archer "Number Stories of Long Ago" --Smith pp. 45-82 "Numbers and Numerals" --Smith "Short Cuts in Computing" --Glenn and Johnson SMSG, Vol. I, Part 1 pp. 29-34	place value place holder period number numeral polynomial expression integer digit units tens hundreds thousands ten-thousands hundred-thousands millions ten-millions hundred-millions billions ten-billions hundred-billions counting numbers addends sum minuend subtrahend difference multiplicand multiplier factor product dividend divisor quotient

TOPICS	OBJECTIVES	SUGGESTIONS
Laws and Properties of Number:	To reinforce whole number concepts	Enrichment: "Number Patterns" Webster Publishing Company
Associative Law for Addition	To provide an adequate background for topic on number systems	Associative Law for Addition: $(2 + 3) + 4 = 2 + (3 + 4)$
Commutative Law for Addition		Commutative Law for Addition: $(2 + 3) = (3 + 2)$
Associative Law for Multiplication		Associative Law for Multiplication: $(2 \times 3) \times 4 = 2 \times (3 \times 4)$
Commutative Law for Multiplication		Commutative Law for Multiplication: $(2 \times 3) = (3 \times 2)$
Distributive Law for Multiplication over Addition		Distributive Law: $2 \times (3 + 4) = (2 \times 3) + (2 \times 4)$
Subtraction and Division are inverse operations of addition and multiplication respectively		$\left(\begin{array}{l} 15 + 85 = 100 \\ 100 - 85 = 15 \end{array}\right)$ and $\begin{array}{r} 6 \times 4 = 24 \\ 24 \div 6 = 4 \end{array}$
Identity element for Addition is 0.		$5 + 0 = 5$
Identity element for Multiplication is 1.		$5 \times 1 = 5$
Law of order in operation		Multiplication, division, addition, subtraction "My Dear Aunt Sally"

FILMS AND FILM STRIPS	EVALUATION	SUPPLEMENTARY REFERENCES	VOCABULARY
13L8 Order of Operation	Identification of laws Examples of laws	"Mathematics Second Course" --Brown, et al pp. 23, 24, 77-79 "Modern Mathematics, Book 1" --Rosskopf, et al pp. 41-66 "Modern Mathematics, Book 2" --Rosskopf, et al pp. 19-23, 27, 28 SMSG, Vol. I, Part 1 pp. 77-93 "Supplementary Units in Contemporary Arithmetic and Elementary Algebra" --Stein pp. 8S, 9S, 11S (laws of numbers) (identity element) p. 10S (inverse operations)	Associative Law Commutative Law Distributive Law identity element inverse

TOPICS	OBJECTIVES	SUGGESTIONS
Number Systems		
History of Numerals Hindu-Arabic Roman p. 7 Egyptian Babylonian	To develop an appreciation of the historical background of number systems	Oral reports Written reports Report on origin of arithmetic words Posters Murals Time line Time chart of Computing Device Developments
Modular arithmetic		Clock
Exponential Notation		Polynomial Expression $432 = (4 \times 10^2) + (3 \times 10^1) + (2 \times 10^0)$
Non-decimal Number Systems; especially Binary Quinary Duodecimal	To deepen an understanding of the decimal system through study of non-decimal numeration systems	Suggested sequence: Counting Converting from decimal to non-decimal notation Converting from non-decimal to decimal notation Tables for addition and multiplication Computation Aids: Abacus Electric abacus Charts of tables Uses of non-decimal notation: Calculators Braille System

FILMS AND FILM STRIPS	EVALUATION	SUPPLEMENTARY REFERENCES	VOCABULARY
8H5 History of Our Number System 43A1 What Are Numbers 43A2 Whole Numbers "Quicker Than You Think" "How Man Learned to Count" "Mathematician and the River" 13L18 Exponents and Logs	See sample test in the appendixes No objective tests available yet	"Computing Devices" --Johnson and Glenn "The Giant Golden Book of Mathematics" --Adler pp. 46, 47 (Modular arithmetic) "Invitation to Mathematics" --Johnson and Glenn pp. 25-28 (Modular arithmetic) "Making Sure of Arithmetic, 8" pp. 460-464 (decimal and non-decimal notation) "Mathematics First Course" --Brown, et al pp. 1-18 (Egyptian, Roman, Babylonian, Hindu-Arabic, polynomial notation, exponents, quinary) "Mathematics Second Course" --Brown, et al pp. 2-20 (Hindu-Arabic, polynomial notation, binary, quinary, exponents) "Modern Mathematics, Book 1" --Rosskopf, et al pp. 29-40 (Roman, binary, quinary)	numeral number symbol Roman Hindu-Arabic Babylonian Egyptian decimal notation digit base exponent power exponential notation modular non-decimal notation binary ternary quaternary quinary senary septenary octonary

TOPICS	OBJECTIVES	SUGGESTIONS

FILMS AND FILM STRIPS	EVALUATION	SUPPLEMENTARY REFERENCES	VOCABULARY
		"Modern Mathematics, Book 2" --Rosskopf, et al pp. 31-35 (Modular arithmetic)	nonary decimal duodecimal
		"Number Stories of Long Ago" --Smith	real number
		"Numbers and Numerals" --Smith pp. 48-50 (Arithmetic words)	
		"Secret Codes, Remainder Arithmetic, and Matrices" --Peck pp. 12-28	
		SFEMP, Booklet 5 (Egyptian, Roman, non-decimal)	
		SMSG, Vol. I, Part 1 pp. 23-72 (Egyptian, Babylonian, Roman, place holder, non-decimal)	
		"Supplementary Units in Contemporary Arithmetic and Elementary Algebra" --Stein pp. 13S-24S (non-decimal)	
		UMMaP, First Book pp. 1-20 (Place value, Roman, Egyptian, Hindu-Arabic, non-decimal)	
		"Understanding Numeration Systems" --Johnson and Glenn	
		"World of Numbers" --IBM	

Unit II - Polygons, Common and Decimal Fractions (6 Weeks)

TOPICS	OBJECTIVES	SUGGESTIONS
Polygons pp. 272-280 288-301 349, 350 (omit VII and VIII) pp. 384, 385 Triangle Scalene Isosceles Equilateral Acute Obtuse Right Quadrilateral Parallelogram Rectangle Square Rhomboid Rhombus Trapezoid Trapezium Pentagon Hexagon Heptagon Octagon Nonagon Decagon Circle	To develop the ability to recognize plane figures To develop a meaningful vocabulary To develop the ability to determine perimeter (circumference) and area of plane surfaces To develop the ability to derive formulas To develop the ability to apply formulas to problem solving	Development plan for each polygon: 1. Definition 2. Types 3. Characteristics 4. Construction a. Using central angles b. Using interior angles 5. Perimeter (circumference) 6. Area Suggested pattern for determining perimeter (circumference) and area: 1. Draw figure 2. Indicate dimensions 3. Use formula } algebraic 4. Show direct substitution } form 5. Label answer Perimeter-area board Construct polygons on squared or colored paper. Models made from: Paper Cardboard Wood Cellophane Plastic Aluminum foil Mobiles Magnetic board Designs made on paper or aluminum plates Make persons or animals from geometric forms cut from colored paper. Make colored designs to be used for a border in the classroom or for decoration on a booklet. Make large drawing or mural for room decoration. Curve stitching Wax paper folding Peg board Adjustable triangles and quadrilaterals Carpenter's rule

FILMS AND FILM STRIPS	EVALUATION	SUPPLEMENTARY REFERENCES	VOCABULARY
11P5 Vocabulary--Triangles	Recognition test	"An Adventure in Geometry" --Ravielli pp. 49-61	plane
	Spelling test		surface
11P6 Vocabulary--Polygons	True, False		polygon
8H1 Area Measures	Matching	"The Giant Golden Book" --Adler pp. 25-27	regular
"Quadrilaterals"	Completion		irregular
"Area"	Multiple choice	"Making Sure of Arithmetic, 8" pp. 41, 164-191	triangle
"Meaning of Pi"			scalene
"Measuring Areas"		"Mathematics First Course" --Brown, et al pp. 167-182 227-243	isosceles
			equilateral
			equiangular
		"Modern Mathematics, Book 1" --Rosskopf, et al pp. 170, 171, 176-185, 188-207 334-337	acute
			obtuse
			right
			quadrilateral
		"Modern Mathematics, Book 2" --Rosskopf, et al pp. 123-135 305-307 312-325	parallelogram
			rectangle
			square
		"Multi-Sensory Aids in Teaching of Mathematics" 18th Yearbook NCTM	rhomboid
			rhombus
			trapezoid
		SMSG, Vol. I, Part 1 pp. 334-350	trapezium
		SMSG, Vol. I, Part 2 pp. 489-523 539-582	pentagon
			hexagon
		"Topology" --Johnson and Glenn	

TOPICS	OBJECTIVES	SUGGESTIONS
		Assign area and perimeter problems dealing with figures which combine 2 or more of the basic polygons. Enrichment: Introduce curves traced by motion of fixed point on a moving basic shape. Ex. cycloids, involutes, spirals See Ravielli, pp. 83-93 Demonstrations in Topology

FILMS AND FILM STRIPS	EVALUATION	SUPPLEMENTARY REFERENCES	VOCABULARY
			heptagon octagon nonagon decagon diagonal interior angles central angles circle circumference radius radii pi π dimensions length width altitude height base perimeter area

Unit II - Polygons, Common and Decimal Fractions

TOPICS	OBJECTIVES	SUGGESTIONS
Common Fractions pp. 68-113 335-338 364 366-369	To reinforce fractional concepts and computation To strengthen the concept of equality and inequality	Drill in fundamental operations Use prime factors in determining L.C.D. Sieve of Eratosthenes Avoid use of the word "CANCEL". Omit pp. 97, 100 in text. Use "divided through by" "internal reduction" Fractions used in: Kitchen Workshop Construction of buildings Sports Measures of time, distance, amount, values, weights Magnetic board Ruler Magic Squares Number Line In preparation for algebra, introduce horizontal pattern for adding and subtracting fractions. Example: $\frac{1}{2} + \frac{1}{4} = \frac{2+1}{4} = \frac{3}{4}$ Drill on multiplying fraction by itself in preparation for squaring and finding square root of a fraction °°Discussion on "why" invert divisor when dividing fractions. °°May wish to introduce "common denominator method" for dividing fractions. Example: $12 \div \frac{3}{4} = \frac{48}{4} \div \frac{3}{4} = 16$ °°Introduce complex fractions as means of enrichment and in preparation for expressing certain per cents as equivalent common fractions. °°See Brueckner reference.

FILMS AND FILM STRIPS	EVALUATION	SUPPLEMENTARY REFERENCES	VOCABULARY
25S6 Reducing and Changing Fractions 25S7 Changing to a Common Denominator, Part I	Daily quiz	"Developing Mathematical Understandings in the Upper Grades" --Brueckner, et al pp. 174-224	numerator denominator mixed number
25S8 Changing to a Common Denominator, Part II		"Making Sure of Arithmetic, 8" pp. 8-19	common fraction improper fraction
25S11 Reciprocals--Rule of Division		"Modern Mathematics, Book 1" --Rosskopf, et al pp. 67-95	equivalent invert inversion
	Attainment Tests 5 and 6 pp. 399, 400	"Modern Mathematics, Book 2" --Rosskopf, et al pp. 37-50	reciprocal rational number
	Supplementary Exercises 5 and 6 pp. 399, 400 Unit Test 2	"Supplementary Units in Contemporary Arithmetic and Elementary Algebra" --Stein pp. 6S, 7S	complex fraction multiple common multiple
		UMMaP, First Book pp. 103-131	least common multiple L.C.M.
		UMMaP, Teacher's Guide First Book pp. 85-107	factor prime number prime factor least common denominator L.C.D. terms of fraction lowest terms

TOPICS	OBJECTIVES	SUGGESTIONS
		Estimate sums such as $4\frac{3}{16} + 3\frac{5}{12}$ to see that result is between 7 and 8. Helps develop concept of "more than" and "less than". Inequality: $\frac{1}{2} > \frac{1}{4}$

FILMS AND FILM STRIPS	EVALUATION	SUPPLEMENTARY REFERENCES	VOCABULARY

TOPICS	OBJECTIVES	SUGGESTIONS
Decimal Fractions pp. 114-161 339-341 370-375 Omit pp. 137, 138, 142, 143, 159	To reinforce the understanding of decimal notation, operations with decimals, relationship to common fractions, and the practical applications of decimal fractions	The past experience of the members of the class will determine the point of departure for developing the section on decimal fractions. Use monetary system as special form of decimals. Use graph paper to show decimal parts. Show meaning of each "9" in such numbers as 999.999. Use "0" as a place holder in aligning decimal places for addition and subtraction to avoid "ragged" form. Arrange decimal fractions and common fractions according to size. Stress inequalities: $.03 < .3$ $\frac{7}{8} > .7$ Further develop concept of "more than" and "less than" by using exercises such as: If 17 is multiplied by .1, will the product be greater than, or less than, 1? If 1000 is multiplied by .999, is the product greater than, or less than, 1000? Develop decimal equivalent tables. See Brown and Sharpe Mfg. Co. charts Bruning Company, Inc. charts Memorize decimal equivalents for fractions most frequently used. Matching games Division of decimals should be more easily understood if stress is placed on pp. 126 and 133 of text dealing with multiplication and division by multiples of 10.

FILMS AND FILM STRIPS	EVALUATION	SUPPLEMENTARY REFERENCES	VOCABULARY
4U1 Meaning and Reading of Decimals	Attainment Test 7, p. 402	"Making Sure of Arithmetic, 8" pp. 26-35	decimal fraction place value
4U3 Multiplication of Decimals	Attainment Test 8, p. 403	"Modern Mathematics, Book 1" --Rosskopf, et al pp. 96-125	decimal point annexing zeros
4U4 Division of Decimals			
4U5 Changing Fractions to Decimals		SMSG, Vol. I, Part 2 pp. 403-423	decimal equivalent tenths
"Decimal Fractions"		UMMaP, First Book pp. 131-143	hundredths
"Decimals Are Easy"	Unit Test 3	UMMaP, Teacher's Guide First Book pp. 107-115	thousandths ten-thousandths hundred-thousandths millionths

TOPICS	OBJECTIVES	SUGGESTIONS
		Avoid use of "caret" in division by decimal fraction. Emphasize fact that both dividend and divisor are multiplied by same multiple of 10. Bulletin board for clippings showing use of decimal fractions Posters showing: Speedometers Road maps Standings of athletic teams Amounts of rainfall
Scientific notation	To develop the ability to use scientific notation	Use scientific notation to indicate very large and very small numbers. $94,452,000 = 9.4452 \times 10^7$ $.0000034 = 3.4 \times \frac{1}{10^6}$ Slide rule

FILMS AND FILM STRIPS	EVALUATION	SUPPLEMENTARY REFERENCES	VOCABULARY
		"Computing Devices" --Johnson and Glenn	scientific notation
		"Modern Mathematics, Book 2" --Rosskopf, et al pp. 64-65	
		SFEMP, Booklet 5 p. 52	
		"Supplementary Units in Contemporary Arithmetic and Elementary Algebra" --Stein pp. 25S-28S	

Unit III - Percentage (4 Weeks)

TOPICS	OBJECTIVES	SUGGESTIONS
Percentage Understanding Per Cents pp. 186-193 202, 206 244, 344	To develop the ability to understand the meaning of per cents To develop the ability to interchange per cents, common fractions and decimal fractions To develop the ability to use per cents in computation	Use bulletin board to display newspaper clippings, labels and tags on garments which indicate how per cents are used. Reports on history of "%" symbol and at same time investigate other symbols such as ¢, $, +, -, ÷, x. Enclose 100 squares on graph paper to show the meaning of per cent. Use blackboard graph chart. 100 Bar Charts (p. 244 of text) Fraction (per cent) Wheel Memorize equivalents. Use games and class drills in equivalents. Be sure to include per cents greater than 100% and less than 1%.
Finding the Percentage pp. 194-199 344-347	To develop the ability to find the percentage	P = BR may be used. The percentage statement, 50% of 80 is 40, is a closed sentence. If one of the elements is missing, it is a sample of an open sentence. 50% of 80 is ______ . Other forms to be developed in this unit: 25% of ______ is 7. 18 is _____ % of 36.
	To further develop the concepts of equality and inequality	Statement of equality and inequality: Select correct symbol: 6% of 100 (=, <, >) 3% of 200 $12\frac{1}{2}\%$ of a gallon (=, <, >) 2 pints 18 inches (=, <, >) 75% of one yard

FILMS AND FILM STRIPS	EVALUATION	SUPPLEMENTARY REFERENCES	VOCABULARY
"Meaning of Percentage" "Percentage"	Test on interchanging common fractions, decimal fractions, and per cents Reading and interpreting shaded plane figures	Note: References refer to entire unit on percentage. "Developing Mathematical Understandings in the Upper Grades" --Brueckner, et al pp. 225-247 "Making Sure of Arithmetic, 8" pp. 66-111 "Mathematics First Course" --Brown, et al pp. 183-209 "Mathematics Second Course" --Brown, et al pp. 163-180	per cent %
	Attainment Test 10, p. 406	"Modern Mathematics, Book 1" --Rosskopf, et al pp. 126-155 "Modern Mathematics, Book 2" --Rosskopf, et al pp. 89-99 SMSG, Vol. I, Part 2 pp. 393-403 422-437	closed sentence open sentence percentage

TOPICS	OBJECTIVES	SUGGESTIONS
Find the amount of increase and decrease. p. 200		Point out that per cents greater than 100% of a unit increase the original unit; while per cents less than 100% decrease the original unit.

Orig. Cost	Cost Decreased 25% or $\frac{1}{4}$	Cost Decreased 50% or $\frac{1}{2}$	Cost Decreased 75% or $\frac{3}{4}$
○	○	○	○
○	○	○	
○	○		
○			

FILMS AND FILM STRIPS	EVALUATION	SUPPLEMENTARY REFERENCES	VOCABULARY
			increase decrease discount net price depreciate

Unit III - Percentage

TOPICS	OBJECTIVES	SUGGESTIONS
Finding the Rate (per cent) pp. 210, 346, 347	To develop the ability to find the rate	Open sentence: 18 is ______ % of 36. $\frac{18}{36} = \frac{1}{2} = 50\%$ Closed sentence: 18 is _50_ % of 36. $R = \frac{P}{B}$ may be used.
Find the Base pp. 227, 228, 347	To develop the ability to find the base (whole, 100%)	Open sentence: 25% of ______ is 7. $\frac{7}{25\%} = \frac{7}{.25} = \frac{7}{\frac{1}{4}} = 28$ Closed sentence: 25% of _28_ is 7. $B = \frac{P}{R}$ may be used.
		Review: Selected sections on percentage. pp. 202 225 352 209 230 376 217 231 379 222 380

FILMS AND FILM STRIPS	EVALUATION	SUPPLEMENTARY REFERENCES	VOCABULARY
	Short Tests		rate
	Keeping In Practice		
	Attainment Test 11, p. 407		
			base
	Test Unit 4		

Unit IV - Measurements, Graphs, Ratios (2 Weeks)

TOPICS	OBJECTIVES	SUGGESTIONS
Common Measures pp. 166-185 Tables pp. 387, 388	To strengthen the ability to use various units of measure and to compute using these measures	Approximately three class periods should be used for this topic. Note: Review tables of measure in class. Assign problems on pp. 172, 173, 175, 179, 184, 185, 342, 343.

FILMS AND FILM STRIPS	EVALUATION	SUPPLEMENTARY REFERENCES	VOCABULARY
4U7 Advancing in Quantitative Measurements	Attainment Test 9, pp. 404, 405	"Modern Mathematics, Book 1" --Rosskopf, et al pp. 222-226 231-270	dry measure ounce pint quart peck bushel
8H6 History of Telling Time	Supplementary Exercise 9 p. 405	"Modern Mathematics, Book 2" --Rosskopf, et al pp. 165-175	liquid measure ounce pint quart gallon
"Weights and Measures"		UMMaP, First Book pp. 293, 296-303, 309-318	time measure second minute hour day week month year
			weights ounce pound hundredweight ton
			kitchen measure teaspoon tablespoon cup

TOPICS	OBJECTIVES	SUGGESTIONS
Graphs pp. 232-244	To develop the ability to read, draw, and interpret various kinds of graphs	Assemble bulletin board displays of commercial and pupil made graphs. Use graphs distributed by "Road Maps of Industry". Collect data from newspapers and magazines. Suggested data for graphing: Bar Graphs: Daily precipitation in Cleveland Temperature for Cleveland for a week Depth of Great Lakes Heights of tall buildings in Cleveland Terminal Tower, Cleveland Electric Illuminating Co., East Ohio Gas Co., Ohio Bell Telephone Co. Speed of various means of transportation Life expectancy of various household pets Circle Graphs: Fractional parts of day spent in sleeping, eating, school, studying, and playing Stress horizontal and vertical scales. Explore the possibility of graphs extending into all four quadrants. Show "x" and "y" axes using signed numbers. Good report material in "The World of Statistics" ...Webster Series

FILMS AND FILM STRIPS	EVALUATION	SUPPLEMENTARY REFERENCES	VOCABULARY
13L22 Graph Uses "Language of Graphs"	Construct and interpret graphs.	"Developing Mathematical Understandings in the Upper Grades" --Brueckner, et al pp. 331-336 "Mathematics First Course" --Brown, et al pp. 161-165 249-274 "Mathematics Second Course" --Brown, et al pp. 59-74 "Modern Mathematics, Book 1" --Rosskopf, et al pp. 294-311 SMSG, Vol. I, Part 2 pp. 597-608 "The World of Statistics" --Johnson and Glenn	table of data statistics graph horizontal scale vertical scale axis quadrant pictograph bar graph horizontal bar graph vertical bar graph line graph band chart

TOPICS	OBJECTIVES	SUGGESTIONS
Ratios pp. 247-259 263	To develop an understanding of ratio as: 1. Method of comparing like quantities by division	Stress vocabulary when making comparison by: subtraction - (more than, less than) division - (how many times, what part of)
	2. Relationship of an ordered pair of numbers 3. Applied to scale drawing	Aids: Enlarged and scaled down pictures as shown in books and encyclopedias Blueprints House plans Maps Foot ruler compared to yardstick Measuring cups of graduated sizes Cubical counting blocks

FILMS AND FILM STRIPS	EVALUATION	SUPPLEMENTARY REFERENCES	VOCABULARY
13L17 Ratios and Proportion	Short quiz Attainment Test 12, p. 409	"Developing Mathematical Understandings in the Upper Grades" --Brueckner, et al pp. 343-346	ratio ordered pair reciprocal
	Unit Test 5	"Mathematics First Course" --Brown, et al pp. 155-166	
	Final Test	"Modern Mathematics, Book 1" --Rosskopf, et al pp. 271-293	
		"Modern Mathematics, Book 2" --Rosskopf, et al pp. 67-78	

SECOND SEMESTER - Making Sure of Arithmetic, 8

Unit 1 - Applied Geometry (4 Weeks)

TOPICS	OBJECTIVES	SUGGESTIONS
Proportion pp. 323-325 341	To develop an understanding of proportion as two equivalent ratios	Algebraic method may be used to determine the missing term in a given proportion. $\frac{x}{15} = \frac{2}{3}$
	To develop the ability to: 1. Set up a proportion	Use comparison of perimeters and areas of various similar polygons.
	2. Interpret a proportion	Use increase or decrease in recipe ingredients.
	3. Solve a proportion	
Scale Drawing and Indirect Measurement pp. 326-333 414, 415	To develop the ability to construct and interpret scale drawings	Use maps blueprints dictionaries encyclopedias graph paper
	To develop the ability to measure indirectly by using:	Review construction of triangles by angle measure.
	1. Similar triangles	Measure heights of buildings, trees, distance across the lake.
	2. Scale drawings	Project on construction of a transit

FILMS AND FILM STRIPS	EVALUATION	SUPPLEMENTARY REFERENCES	VOCABULARY
13L17 Ratios and Proportions	Completion Test True, False Test Problem solving	"Mathematics Second Course" --Brown, et al pp. 149-151, 244-247 "Modern Mathematics, Book 2" --Rosskopf, et al pp. 79-85 SFEMP, Booklet 4	proportion term means extremes inverse equivalent simplify
	Sketches Constructions Interpretations Problem solving	"Mathematics Second Course" --Brown, et al pp. 247-254 "Modern Mathematics, Book 2" --Rosskopf, et al pp. 86-88, 326-329 "Wonderful World of Mathematics" --Hogben pp. 31-38	scale drawing scale reduction enlargement corresponding dimensions similar triangle ∼ △ indirect measurement

TOPICS	OBJECTIVES	SUGGESTIONS
Square Root pp. 334-337 465, 466	To develop an understanding of the concept of square root To develop the ability to estimate and extract square roots	In relation to square root, discuss meaning, estimating, interpolating, extracting. Use arithmetic method based on $(a - b)^2$ to extract square root. Practice reading table of squares and square roots.
Right Triangle Rule pp. 338-340 342, 416	To develop the ability to understand and use the right triangle rule	Review construction of right triangles. Have students derive right triangle rule. Report on Pythagoreans. Posters or reports on proofs of right triangle rule Use formula in solving problems dealing with right triangles. You may wish to introduce the following as means of enrichment: 1. Distance formula - See "Modern Mathematics, Book 2" pp. 337, 338 2. Trigonometric ratios - See "Modern Mathematics, Book 1" pp. 340-344

FILMS AND FILM STRIPS	EVALUATION	SUPPLEMENTARY REFERENCES	VOCABULARY
13L7 Square Root and Cube Root	Compute squares and square roots	"Developing Mathematical Understandings in the Upper Grades" --Brueckner, et al pp. 365-372 "Mathematics Second Course" --Brown, et al pp. 348-350 "Modern Mathematics, Book 2" --Rosskopf, et al pp. 331-335	perfect square square root square radical $\sqrt{\ }$ irrational number
	Problem solving by using right triangle formula Attainment Test 10, pp. 444, 445 Supplementary Exercise 10, p. 445	"The Giant Golden Book of Mathematics" --Adler pp. 33-35 "Mathematics Second Course" --Brown, et al pp. 254-258 "Modern Mathematics, Book 2" --Rosskopf, et al pp. 330, 336-339 "The Pythagorean Theorem" --Glenn and Johnson	right triangle angle arms (legs) hypotenuse formula Pythagorean Theorem Pythagoras diagonal

Unit II - Polyhedrons (5 Weeks)

TOPICS	OBJECTIVES	SUGGESTIONS
Polyhedrons pp. 193-217 403, 404	To develop the ability to understand and to appreciate the simple relationships between form and function of solids found in our environment To develop the ability to identify various polyhedrons To develop a meaningful vocabulary To develop the ability to derive surface area and volume formulas To further develop the ability to apply formulas to problem solving	Have pupils bring samples of solids to class. Boxes Cans Baseball Crystals Have pupils bring pictures of solids to class. Ice cream cone Igloo Volcano Tent Tepee Silo Pyramids of Egypt Identify the general shape of many common specific objects. Construct models using plastic, paper, wood, cellophane. Construct mobiles. Use inch cubes to construct rectangular prism. Assign students to demonstrate derivation of formula for: 1. Volume of a Cone: $V = \frac{1}{3}\pi r^2 h$ Use cone and cylinder of same base and height. Fill cone with water and empty into cylinder. See p. 210 of text. 2. Volume of a Pyramid: $V = \frac{1}{3}Bh$ Same method as above. See p. 211 of text. 3. Surface area of a Sphere: $A = 4\pi r^2$ See p. 212 of text.

FILMS AND FILM STRIPS	EVALUATION	SUPPLEMENTARY REFERENCES	VOCABULARY
8H3 History of Weight Volume 13L13 Scales and Models "Surface Areas of Solids" I and II "Volume and Its Measurement" "Volumes of Cubes, Prisms, Cylinders" "Volumes of Pyramids, Cones, Spheres"	Recognition of solid figures Matching test Vocabulary test Spelling test Formula test Problem solving using formulas Attainment Test 6, p. 437 Supplementary Exercise 6, p. 437	"An Adventure in Geometry" --Ravielli pp. 63-79 "Developing Mathematical Understandings in the Upper Grades" --Brueckner, et al pp. 403-411 "The Giant Golden Book of Mathematics" --Adler "Mathematics First Course" --Brown, et al pp. 243-248 "Modern Mathematics, Book 1" --Rosskopf, et al pp. 157, 167-169 172-175 186, 187 "Modern Mathematics, Book 2" --Rosskopf, et al pp. 136-147 SMSG, Vol. I, Part 1 pp. 351-374	polyhedron polyhedrons (polyhedra) solid dimension altitude base face vertex vertices edge apex prism triangular prism rectangular prism hexahedron cube right prism oblique prism parallelopiped pyramid triangular pyramid square pyramid

TOPICS	OBJECTIVES	SUGGESTIONS
		4. Volume of a Sphere: $V = \frac{2}{3}(\pi r^2 h)$ $V = \frac{2}{3} \times \pi \times r \times r \times 2 \times r$ $V = \frac{4}{3}\pi r^3$ Use hollow ball and cylinder whose base diameter and height is equal to diameter of ball. Fill ball with water or sand and empty into cylinder. May wish to assign surface area and volume problems dealing with objects which combine two or more basic polyhedrons.

FILMS AND FILM STRIPS	EVALUATION	SUPPLEMENTARY REFERENCES	VOCABULARY
			cylinder
			disk
			cone
			sphere
			hemisphere
			tetrahedron
			octahedron
			dodecahedron
			icosahedron
			frustrum
			truncated
			lateral area
			total surface area
			capacity
			volume
			cubic measure
			board feet

TOPICS	OBJECTIVES	SUGGESTIONS
Sets How to indicate a. Description b. Listing	To develop an understanding of the concepts, vocabulary, and symbolism of sets To develop the skill of specifying sets by tabulation or description (To the teacher: This should be a very simple approach utilizing pupils' experiences as concrete content.)	Teacher Background: "Sets, relations, and functions" A guide for teachers issued by the Commission on Mathematics of the College Entrance Examination Board NCTM 23rd Yearbook - Chapter 3 NCTM 24th Yearbook - Chapters 2, 3 Introduction to the Theory of Sets Breuer - translated by Fehr Principles of Mathematics Allendoerfer and Oakley - Chapter 5 "Introduction to Sets and the Structure of Algebra" Krickenberger and Pearson "Elementary Concepts of Sets" Woodward and McLennan
	To develop the ability to draw and interpret simple Venn diagrams	Teachers must be well prepared in content in order to undertake this unit. Whatever source book is chosen should be carefully studied. Each problem should be worked out individually by the teacher before presentation to the class. This unit cannot be taught by casual inspection on the part of the teacher. Develop vocabulary very slowly and carefully by the discovery method. Examples: $\{ \}$ "the set of" The set of all the days of the week whose names begin with "s". $S = \{\text{Sunday, Saturday}\}$

FILMS AND FILM STRIPS	EVALUATION	SUPPLEMENTARY REFERENCES	VOCABULARY
Film-of-the-Month Club 355 Lexington Avenue New York 17, New York 1101 - Equations and Inequalities	Prepare a matching test to find out if pupils recognize symbols such as: $\{\ \}$ $\emptyset$ ϵ $\notin$	"Modern Mathematics, Book 2" --Rosskopf, et al pp. 208-211 "Modern Mathematics--Topics and Problems" --Aiken and Beseman pp. 1-15 112-119 "Sets, Sentences, and Operations" --Johnson and Glenn pp. 2-13, 29	set list describe tabulate place holder element member subset
	Prepare tests on solution of sets	SFEMP, Booklet 1 "Sentences and Sets" pp. 1-9 18, 19 "Supplementary Units in Contemporary Arithmetic and Elementary Algebra" --Stein pp. 34S-36S Exercise 6	Venn diagram finite infinite empty set natural number real number absolute value
	Solve problems by the use of simple Venn diagrams.		intersection union variable universal replacement set one-to-one correspondence

TOPICS	OBJECTIVES	SUGGESTIONS
Sentences, Inequalities	To develop the ability to read and write the symbolism of equations and inequalities	This unit should not be too elaborate. Simplicity in regard to sentences and inequalities should be painstakingly planned. Teacher references: Report of the Commission on Mathematics of CEEB - Appendices Sets (selected pages) Sentences (selected pages) Inequalities (selected pages)
Simple Equations pp. 343-355	To develop the ability to write open sentences using literal numbers To develop the ability to solve simple equations	Devise worksheets to give practice in converting from verbal statements to literal notation and from literal notation to verbal statements.

FILMS AND FILM STRIPS	EVALUATION	SUPPLEMENTARY REFERENCES	VOCABULARY
Film Strip-of-the-Month 1101 Equations and Inequalities	Prepare a matching test to find out if pupils recognize such symbols as: || ≥ ≤ Sentences, true or false List a set and have pupils describe. Describe a set and have the pupils list. Differentiate between open and closed sentences.	"Modern Mathematics, Book 2" --Rosskopf, et al pp. 212, 217, 218, 378 (Exercises 1-8) "Modern Mathematics--Topics and Problems" --Aiken and Beseman pp. 10-15 (select appropriate sections) SFEMP, Booklet 1 pp. 10-13 16, 17 SFEMP, Booklet 2 pp. 1-38 "Supplementary Units in Contemporary Arithmetic and Elementary Algebra" --Stein pp. 32S-34S	solution set equivalent set solution equal set absolute value
"Mysterious 'X'" 13L20 Equations and Formulas			

Unit IV - Applied Percentage (4 Weeks)

TOPICS	OBJECTIVES	SUGGESTIONS
Percentage pp. 68-72, 75, 84, 99, 264	To reinforce the fundamental ideas of percentage	Review interchange of common fractions, decimal fractions, and per cents.
Discount pp. 79, 106, 274, 275		
Commission pp. 86, 270, 271	To develop the ability to compute commission	Commission Merchants: Salesmen (newspapers, magazines, Christmas cards) Brokers Real Estate Dealers Automobile Dealers
Rate of Commission p. 87	To develop the ability to compute rate of commission	
Simple Interest pp. 122-128, 133	To develop the ability to understand the interest formula and its applications	Use pp. 108, 109 as review material. Take stocks and bonds as report material. Have pupils "buy" 100 shares of stock and follow the price fluctuations for a short period of time. Record data and graph.
Promissory Notes pp. 287-291		
Savings Accounts pp. 129-131		
Compound Interest pp. 309-311		Extra problems pp. 412, 413
Profit and Loss pp. 276-281 378, 379		

FILMS AND FILM STRIPS	EVALUATION	SUPPLEMENTARY REFERENCES	VOCABULARY
Filmstrips: Buying and Selling Commission Interest "How Banks Serve" "A Day at the Federal Reserve Bank of Cleveland" "Using the Bank"	p. 106, Review Understanding Per Cents on p. 107 Making Sure of Per Cents p. 111 Keeping in Practice, p. 105 Attainment Test 2, p. 429 Supplementary Exercise 2, pp. 429, 430 Making Sure of Money and Interest, p. 135 Review on pp. 284, 285	"Developing Mathematical Understandings in the Upper Grades" --Brueckner, et al pp. 247-260 "Mathematics First Course" --Brown, et al pp. 211-226 "Mathematics Second Course" --Brown, et al pp. 181-204	per cent base rate percentage discount rate of discount commission rate of commission net proceeds principal interest rate maker date of maturity promissory note proceeds bank discount Federal Deposit Insurance Corp. compound interest margin expenses profits selling price

TOPICS	OBJECTIVES	SUGGESTIONS
Insurance pp. 137-147	To develop the ability to understand the principles and purposes of insurance	Class discussions and reports on various types of insurance.

FILMS AND FILM STRIPS	EVALUATION	SUPPLEMENTARY REFERENCES	VOCABULARY
	Attainment Test 4, p. 432 Examples 1-5 Supplementary Exercise 4, p. 433	"Developing Mathematical Understandings in the Upper Grades" --Brueckner, et al pp. 260-269 Institute of Life Insurance Booklets	policy policyholder insure face value premium premium rate annual liability comprehensive hospitalization benefit beneficiary term ordinary life endowment limited payment life dividend cash surrender value disability compensation deductions casualty life expectancy annuity

Unit IV - Applied Percentage

TOPICS	OBJECTIVES	SUGGESTIONS
Taxes pp. 150-161	To develop an awareness of the kinds of taxes and to compute the tax levied	Reports on taxes Study income tax forms. Large tax forms are available from Collector of Internal Revenue. Secure tax rate on property from County Treasurer's Office or from local newspaper.

FILMS AND FILM STRIPS	EVALUATION	SUPPLEMENTARY REFERENCES	VOCABULARY
Film strips: State and Local Taxes Federal Taxes Property Taxation	Attainment Test 4, p. 433 Examples 6-11 Supplementary Exercise 4 p. 434 Review pp. 162, 163		tax customs duty customs revenue internal revenue excise tax sales tax tax rate income tax deduction exemption assessed valuation mill tariff ad valorem specific duty consumer gross income net income rebate

VOCABULARY LIST

VOCABULARY LIST

A

absolute value
acute
addends
adjacent
ad valorem
altitude
angle ∠
annexing zeros
annual
annuity
apex
arc
area
arms
assessed valuation
associative
axes
axis

B

Babylonian
band chart
bank discount
bar graph
base
beneficiary
benefit
billions
binary
bisect
bisector
board feet
bushel

C

capacity
cash surrender value
casualty
centimeter
central angle
circle
circumference
closed sentence
commission
common fraction
common multiple
commutative
compensation
complementary
complex fraction
compound interest
comprehensive
cone
construction
consumer
corresponding dimensions
counting numbers
cube
cubic measure
cup
curved line
customs duty
customs revenue
cylinder

D

date of maturity
day
decagon
decimal
decimal equivalent
decimal fraction
decimal notation
decimal point
decrease
deductions
degree
denominator
depreciate
describe
diagonal
difference
digit
dimensions
disability
discount

disk
distributive
dividend
divisor
dodecahedron
dry measure
duodecimal

E

edge
Egyptian
element
empty set
endowment
enlargement
equal set
equiangular
equilateral
equivalent
equivalent set
error of measurement
excise tax
exemption
expenses
exponent
exponential notation
extremes

F

face
face value
factor
Federal Deposit Insurance Corporation
finite
foot
formula
frustrum

G

gallon
graph
gross income

H

height
hemisphere
heptagon
hexagon
hexahedron
Hindu-Arabic
horizontal
horizontal bar graph
horizontal scale
hospitalization
hour
hundred-billions
hundred-millions
hundreds
hundred-thousands
hundred-thousandths
hundredths
hundredweight
hypotenuse

I

icosahedron
identity element
improper fraction
inch
income tax
increase
indirect measurement
infinite
insure
integer
interest rate
interior angles
internal revenue
intersecting
intersection
Intuitive Geometry
inverse
inversion
invert
irrational number
irregular
is equal to $=$
is greater than $>$
is less than $<$
is not equal to $\neq$

is not greater than $\ngtr$
is not less than $\nless$
isosceles

J - K

kitchen measure

L

lateral area
least common denominator L.C.D.
least common multiple L.C.M.
legs
length
liability
life expectancy
limited payment life
line
linear measure
line graph
line segment
liquid measure
list
lowest terms

M

maker
margin
means
member
meter
Metric System of Measure
mile
mill
millimeter
millions
millionths
minuend
minute
mixed number
modular
month
multiple
multiplicand
multiplier

N

natural number
net income
net price
net proceeds
nonagon
nonary
non-decimal notation
number
numeral
numerator

O

oblique
oblique prism
obtuse
octagon
octahedron
octonary
one-to-one correspondence
open sentence
ordered pair
ordinary life
ounce

P

parallel
parallelogram
parallelopiped
peck
pentagon
per cent
percentage
perfect square
perimeter
period
perpendicular
pi
pictograph
pint
place holder
place value
plane
point
policy
policyholder
polygon

J

polyhedra
polyhedron
polynomial expression
pound
power
precision
premium
premium rate
prime factor
prime number
principal
prism
proceeds
product
profit
promissory note
proper fraction
proportion
protractor
pyramid
Pythagoras
Pythagorean Theorem

Q

quadrant
quadrilateral
quart
quaternary
quinary
quotient

R

radical
radii
radius
rate
rate of commission
rate of discount
ratio
rational number
ray
real number
rebate
reciprocal
rectangle
rectangular prism
reduction
reflex
regular polygon
replacement set
rhomboid
rhombus
right prism
right triangle
rod
Roman

S

sales tax
scale
scale drawing
scalene
scientific notation
second
selling price
senary
septenary
set
sides
similar triangle
simplify
solid
specific duty
sphere
square
square prism
square pyramid
square root
standard unit
statistics
straight
straightedge
straight line
subset
subtrahend
sum
supplementary
surface
symbol
symmetry

T

table of data
tablespoon
tabulate
tariff
tax
tax rate
teaspoon
ten billions
ten millions
tens
tenths
ten-thousands
ten-thousandths
term
terms of a fraction
ternary
tetrahedron
thousands
thousandths
time measure
tolerance
ton
total surface area
transversal
trapezoid
trapezium
triangle
triangular prism
truncated

U

union
units
universal

V

variable
Venn diagram
vertex
vertical
vertical bar graph
vertical scale
vertices
volume

W

week
weights
width

Y

yard
year

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APPENDIXES

APPENDIX I

SAMPLES

Sample letter informing parents about the program

Dear Parent(s):

________________ School has been selected as one of the schools which will experiment with an accelerated program in mathematics. The course for pupils placed in this trial group will be difficult. Participation in it will require special attitudes and understandings on the part of pupils and parents.

Since your child has been selected as one of the 7B pupils to take part in this new course, ______________________ School invites you to a conference at which this expanded mathematics program will be discussed. This meeting will take place on __________________ at ___________________ in the school library.

We strongly urge the attendance of at least one parent at this discussion. The success or failure of your child in this program depends partly on the enthusiasm of the parents.

Sincerely,

Principal

Sample Outline of Procedures and Activities for One Seventh Grade Class in Mathematics for Academically Talented Pupils

I. Method of Procedure

- A. Outline followed in Teacher's Guide for 7B and 7A
- B. Radio lessons - "Get the Answer Right!"
- C. Visual aids (films, posters, etc)
- D. Tests given on all units

II. Typical Daily Class Pattern

- A. Quick work - 5 minutes at the beginning of the period
  - 1. Fundamentals
  - 2. Spelling
  - 3. Type problems from the last assignment
- B. Development and explanation of new topics
- C. Assignment on topics explained
- D. Review previous assignment
- E. Emphasis on vocabulary and spelling of new terms
- F. Pupil recitation on topic of the day or special reports
- G. Board work (contest form)
- H. Mental arithmetic during the last 2 minutes of each period

III. Projects

- A. Individual notebooks for Geometry unit
- B. Illustrate all topics by drawings, clippings, or newspaper articles.
- C. Reports made by members of the class on topics of choice
- D. Large display posters by pupils as a special group project
- E. Bulletin board displays in charge of rotating committees
- F. Books on mathematics and related subjects presented and discussed

IV. Comments

- A. First semester a success in that it was stimulating to pupils and the teacher
- B. Challenge to pupils to work up to ability rating
- C. Course of study completed
- D. Time of class period should be arranged in the school day so that it will not be shortened nor omitted.
- E. Pupils were able to maintain satisfactory marks in other subjects.
- F. Incentive to other pupils to work harder especially friends of pupils in this class
- G. Work for teacher tremendous but rewarding.
- H. Plans for second semester
  - 1. Class will meet during a period that will not be shortened.
  - 2. Math club organized
  - 3. Bulletin board committees formed
  - 4. Pupil aides appointed

This worksheet is to acquaint you with the phase of modern mathematics called SETS.

A clearly defined collection of things, objects, or people is called a set.
Example: The set of pupils in the classroom whose first names begin with the letter "J". {John, Jane, Joseph, James}

{ } These braces are read "the set of".

A set is referred to by listing the individuals within the braces. The individuals listed are called the members or elements of the set. The following sentences describe sets. List the elements of each set within braces:

1. The set of all the planets inside the orbit of Earth.

____

2. The set of all of the states of the United States whose names begin with the letter "O".

____

3. The set of all the days of the week.

____

4. The set of the first four Presidents of the United States.

____

5. The set of all the natural numbers greater than 5 but less than 12.

____

In each of the following, all of the members of a set are listed within the braces. Write a description of each set. Note that it is possible to describe a set in a number of different ways.

6. {Saturday, Sunday}

____

7. {April, August}

____

8. {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}

____

9. {2, 4, 6, 8, 10}

____

10. {Harding, Coolidge, Hoover, Roosevelt, Truman, Eisenhower}

____

It is possible to refer to a set in two ways, by listing the individual elements, or by describing the set.

11. In problems 1-5, each is answered by ____________________ the set.

12. In problems 6-10, each is answered by ____________________ the set.

Sample Test on Number Systems

I. Write each of the following numbers using Roman Numerals:

1. Thirty-six ________
2. Seventy-nine ________
3. Three hundred ninety ________
4. Five thousand ________
5. Nineteen hundred sixty-one ________

II. Explain the meaning of these numbers:

1. 32 means ________
2. 237 means ________

III. Write the following using polynomial form:

1. Two hundred fifty-six ________
2. Four thousand twenty-seven ________
3. Twenty-one thousand ________

IV. Change the following base ten numbers to the corresponding base five numbers:

1. 14 = ________ (base 5)
2. 52 = ________ (base 5)
3. 37 = ________ (base 5)
4. 110 = ________ (base 5)
5. 186 = ________ (base 5)

V. Complete the following sentences:

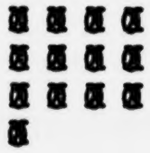
1. In base ten numerals, the place values are all powers of ________.
2. In base seven numerals, the place values are all powers of ________.
3. In base two numerals, the place values are all powers of ________.

VI. Write the numeral that represents the next counting number after each number written below:

1. 44 (base 5) ________
2. 111 (base 2) ________

VII. **Fill in the blank spaces to show the numerals needed to represent the amount shown below in the various number bases.**

Amount =



1. Base 10 = ______________________________
2. Base 5 = ______________________________
3. Base 2 = ______________________________
4. Base 7 = ______________________________
5. Base 3 = ______________________________

Sample Test on Equations and Inequalities

I. Write the following statements using the symbols of mathematics

1. Four is less than five. __________
2. Six plus seven is greater than ten. __________
3. The sum of 3 and 4 is not equal to the sum of 3 and 6. __________
4. Twenty-seven is less than five times six. __________
5. Twelve minus three is not greater than nine. __________

II. Write each of the following statements in words:

1. $4 + 5 > 8$ __________
2. $7 \neq 2$ __________
3. $8 \times 6 \nless 40$ __________
4. $4 + 7 = 6 + 5$ __________
5. $17 - 8 < 23 - 12$ __________

III. Indicate by writing the letter T or F which of the following sentences is true and which is false:

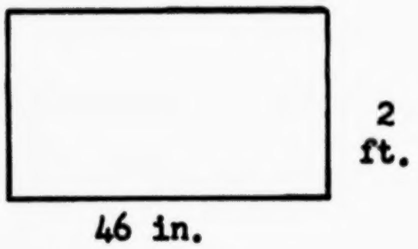
1. $6 + 8 = 5 + 9$ __________
2. $13 + 2 \nless 4$ __________
3. $7 - 6 < 4$ __________
4. $1 + 0 \nless 0 + 1$ __________
5. $\frac{12}{4} < \frac{8}{2}$ __________

IV. Indicate by the letter T or F which of the following statements is true or false when the indicated value is substituted for the variable in the following open sentences:

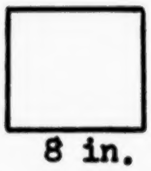
1. When $n = 4$ $n + 2 = 9$ __________
2. When $x = 8$ $5x - 3 = 37$ __________
3. When $y = 4$ $5y > 18$ __________
4. When $n = 7$ $12n - 5 > 2n + 65$ __________
5. When $a = 4$ $\frac{3}{a} + \frac{1}{a} = \frac{a}{a}$ __________

Sample Quick Quizzes

1. Write 24 in base 3.
2. Add: 4.8 + 56.36 + 8
3. 8.6 x 3.5
4. $.75\overline{).25}$
5. $4\frac{1}{2} + 3\frac{1}{3} =$
6. How many degrees are there in every triangle?
7. Find the perimeter of:
8. Find the area of:

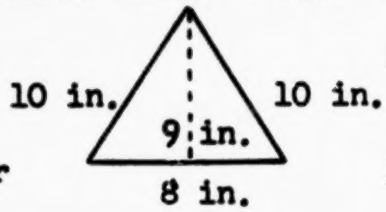


1. Draw an angle of 40°.
2. Draw an obtuse angle and name it XYZ.
3. Add in base 4.
$$\begin{array}{r} 32_{ten} \\ +\ 12_{ten} \\ \hline \end{array}$$
4. Subtract the above.
5. Find the area of



6. Write $\frac{1}{4}$ as a decimal and a per cent.
7. Write $33\frac{1}{3}\%$ as a fraction and a decimal.
8. What per cent of 50 is 10?

1. What is the next number after 19.99?
2. Find the area of:
3. Find the perimeter of:



4. Find 8% of 24.
5. Draw an angle of 130°.
6. Write 42 in base 8.
7. $.8\overline{)64}$
8. $36\overline{).072}$

1. What per cent of 18 is 9?
2. Find 24% of 92.
3. $5\frac{1}{2} + 3\frac{2}{3} =$
4. $\begin{array}{r} 52 \\ \times\ 5\frac{4}{5} \\ \hline \end{array}$
5. Count eight numbers in base two beginning with 0.
6. $.3\overline{)4.29}$
7. $.15\overline{)45}$
8. Express quotient to nearest hundredths:

$.35\overline{)6.4}$

Sample of a Junior Seminar in Mathematics

Participants: Academically Talented Pupils Enrolled in Integrated Plane and Solid Geometry

Getting to Know You: Coordinating Teacher

Introduction: Demonstration Teacher

Part I - Descriptive Geometry

A. Determining the true length of a straight line by means of auxiliary views ....

B. Determining the intersection of planes by auxiliary views ....

Part II - The Ellipse and Other Curves

A. The nature and properties of the ellipse and applications in astronomy ....

B. The elliptic linkage; the twin elliptic pendulum ..

C. Riemannian Geometry; elliptic surfaces ....

D. Lissajous curves ....

E. Conoids, cylindroids, spheroids ....

Part III - Aesthetics in Geometry

A. The Golden Section; studies ....

B. Complex polyhedra ....

Part IV - The Trisection of Angles

A. Trisector linkages ....

Sample of Topics and Projects for Individual Enrichment Study in Geometry

The list of topics given below was gleaned from a much longer list of projects and topics submitted by ninth grade students in an enriched and integrated course in plane and solid geometry. In general, projects take the form of models, bulletin board displays, research papers, or combinations of these three. Many of these projects are general in nature, and lend themselves readily to diversification in individual study. These topics are marked with the number symbol (#). Other topics are more specific. The list is intended merely as a springboard for ideas and a point of departure for students to do work on their own. A good reference library should be available to students doing these or similar projects.

Cavalieri's Solids
The Sphereometer
Spherical Parts (segment, sector, wedge, etc.)
Models of Theorems in Solid Geometry#
Platonic Solids
The Sextant
The Tower of Brahma
The Galton Quincunx (Probability Board demonstrating Law of Pascals Triangle)
Map Projections#
Proof of Euler's Theorem (V + F = E + 2)
The Geometry of Knots#
Feurbach's Theorem
Fermat's Theorem
The trisection of an Angle
The Circle
The Ellipse
The Parabola
The Hyperbola
Model of the Conic Sections
Conics as a Locus
Conics as a projection
Descriptive Geometry (Models and Demonstrations)#
Geometric Fallacies#
Theorems of Menelaus and Ceva
Brocard Points
Non-Euclidean Geometry# (especially that of Riemann and Lobatchevski)
Moebius Strips
Klein's Bottle and other similar surfaces
Geometry of the Sundial
Surveying#
Mascheronian Geometry# (constructions using a compass only)
Halstead's "Rational Geometry" (constructions w/straightedge and dividers only)#
Archimedian Polyhedra#
Keplar-Poinsot Polyhedra
Complex Polyhedra#
Duality of Polyhedra#

Centroids
Geometric Paradoxes#
Cycloids, Helixes, Involutes and Convolutes#
Hyperboloid of One Sheet
Hyperbolic Paraboloid
Spheroids, Cylindroids, Conoids, and Ellipsoids#
Space Geometrics#
Curve Stitching#
General Quadric or Ruled Surfaces#
Unusual Locus Problems#
Different Proofs of the Pythagorean Theorem (There are over 1,000)
Models and Unusual Features of the Pythagorean Theorem#
Geometry in Astronomy
Geometry in Architecture
Geometry in Engineering
Geometry in the Home
Geometry in Art
Geometry in Automobile Designing
The Golden Section#
The Study of Pi
Linkages# (almost endless varieties!)
Elementary Relativity#
Fourth-Dimensional Geometry
"Flatland" (A world with only 2 dimensions)
Probability#
Analogous Reasoning
Symbolic Logic
Geometry in Aeronautics
Navigation
Navigational Instruments
Construction of the Slide Rule
Vector Geometry#
Dihedral and Polyhedral Angles
Geometry of the Infinite#
Construction of the Pyramids of Egypt
The Fibonacci Series
The Simson Line
Paper Folding
Mechanical Models and Teaching Aids#

Sample of a Seventh Grade Mathematics Class Newspaper

MIXED-UP MATH

DIVISION BY ZERO EQUALS?????

Division by zero equals what? Does it equal zero? The answer is definitely no it does not. What does it equal then?

Take this series of quotations and see if you see a pattern in them.

8 divided by 4 is 2
8 divided by 2 is 4
8 divided by 1 is 8
8 divided by 1/2 is 16
8 divided by 1/4 is 32
8 divided by 1/100 is 800

It should be obvious at first glance that as the divisor gets smaller, the quotient gets larger. This means that as the divisor gets close to zero the quotient gets very very large. In fact, when the divisor does reach zero, the quotient becomes too large to define and therefore is called infinity. So in the future, don't ever say the answer to a division by zero is zero.

TEMPERATURES

Can you change thermometer temperatures? If you do not know how, here are the formulas and how to use them.

To change centigrade to the fahrenheit you multiply 9/5 by the centigrade temperature and add 32 to your answer and you have the fahrenheit reading:
F = 9/5 C plus 32

To change fahrenheit to the centigrade, you multiply 5/9 by the fahrenheit temperature and subtract 32 and you have your answer for the centigrade reading.
C = 5/9 F minus 32

SHOW ME

Show that half of twelve is seven.

Show that half of thirteen is eight.

EQUAL SIDES AND EQUAL ANGLES

The symbol of the Office of Civil Defense is a triangle inside a circle. The sides of the triangle are equal and the angles are equal. There are other polygons too. We come across them very often in everyday life. Some wall tiles are regular quadrilaterals or squares. Some floor tiles are regular hexagons.

A regular polygon may have any number of sides, starting with three. One way of making a regular polygon is to calculate the degrees each of its angles should have and then make the angles with a protractor, separating them with equal sides. If the triangle has three sides equal then it will have three equal angles. They will contain 60 degrees each. The four angles of a polygon will always total 360 degrees.

There are short cuts for making the first few polygons. The regular one with three sides is called an equilateral triangle. To make a square, first fold the paper so that the crease goes through the center of the paper. Then draw a circle on this line. Now fold the paper again in order to make a right angle at the center. Open the paper and join the points where the creases cross the circle. The proof of this is shown in plane geometry.

MATHEMATICAL ADVENTURES WITH A SLIDE RULE

A slide rule is used for multiplying and dividing. In most cases, it does not give the exact answer but accuracy to three decimal places. This much exactness is often all the scientist or engineer needs in order to make a decision relative to a problem. To get more accuracy, one might use a computer or work it out on paper with a pencil.

THE ROMAN POUND

The Roman pound (libra) was the hundredth part of an older weight, the talent which is believed to have been originally the weight of an Egyptian royal cubic foot of water. The Roman pound was divided into 12 ounces (unciae, meaning 12 parts) of 437 grains each. This system was introduced into Britain where the pound was increased so as to have 16 of the original ounces. This pound became known as the avoirdupois pound. The word avoirdupois means goods of weight. The idea of a pound divided into 16 parts was not a new one.

The Troy pound is used in England for mint purposes. The origin of the Troy pound and Troy ounce was in Troyes, France. Looking into the history of weights and measures helps the student understand our own systems better. The subject is a very interesting one.

ADVENTURES IN MATHEMATICS

Here are some of the words we use. They are tools of mathematics.

Protractor
Scale
Slide rule
Charts
Compass
Graphs
Calculator
T-Square
Number Sorters

HISTORY OF GEOMETRY

Geometry as a name is derived from the Greeks word for earth and measure. Since geometry had its beginning in 3000 B. C. in Egypt this name is probably a translation of an Egyptian term.

The word refers to the measurement of the earth because the Egyptians needed geometry for measuring pieces of land which had been washed away by the Nile floods. The religion of the Egyptians demanded that they build tombs for their dead. Geometry therefore was needed for the construction of the pyramids. From Egypt a knowledge of geometry spread to Greece.

All early geometry is called intuitive. This means that the facts are accepted without any attempt to prove them. Prehistoric peoples used the intuitive geometry in their weaving and decorations because it was agreeable in its form of symmetry.

In the history of geometry such men as Thales, Pythagoras, Plato, Euclid, and Archimedis were eminent names.

QUESTIONS OF THE WEEK

1. What is 987654321 times 9?
   What is 987654321 times 18?
   What is 987654321 times 27?

2. Can you write 27 with two equal figures?

3. Using all the digits from 1 to 9 represent 100.

4. (a) Think of a number
   (b) Double it
   (c) Add 10
   (d) Divide by 2
   (e) Subtract the number you began with
   (f) Is your answer 5?

APPENDIX II

FREE AND INEXPENSIVE AIDS

USEFUL, FREE AND INEXPENSIVE AIDS TO TEACHING MATHEMATICS
Revised August, 1961

Aluminum Company of America, 1501 Alcoa Building, Pittsburgh 19, Pennsylvania
"Machining Alcoa Aluminum" Geometric applications

American Bankers Association, Council on Banking Education, 12 East 36 Street, New York 16, New York. Good. Send for list on "Banking". Many good pamphlets included in this list.

American Can Company, Home Economics Section, 100 Park Avenue, New York 17, New York. Set of labels for various size cans. Uses and capacity noted for each label.

American Iron and Steel Institute, 150 East 42 Street, New York 17, New York.
"Charting Steel's Progress" -- many graphs and charts.
"Steel Facts"

American Optical Company, Instrument Division, Box A, Buffalo 15, New York.
"Optical Performance Predicted on Paper" -- a chart.

American Trucking Association, Public Relations Dept., 1616 P Street, Washington 6, D. C. "American Trucking Trends"

Association of American Railroads, Public Relations Dept., Transportation Building, Washington 6, D. C.
"A Review of Railway Operations" -- many graphs and tables and statistics.
"A Yearbook of Railroad Information" -- graphs and tables.
"The Day of Two Noons" -- story of standard time. Bibliography.

Atlas Press Company, 1832 N. Pitcher Street, Kalamazoo 1, Michigan.
5 lathe charts--for geometry, formulas, scale drawing, decimal equivalents (25¢)

Bell Telephone Laboratories, Inc., 463 West Street, New York 14, New York.
"It tells how often you will telephone"--a picture and text on the icosahedron.

Boy Scouts of America, 1729 Superior Avenue, N.E., Cleveland 14, Ohio or
The May Company, Public Square, Cleveland 14, Ohio.
Merit Badge Booklets: #3303 Astronomy
#3351 Mechanical Drawing
#3327 Surveying--others. (35¢ each)

Brown and Sharpe Mfg. Co., Providence 1, Rhode Island. "Decimal Equivalents," "How to Read Verniers", "How to Read Micrometers".

Bruning Company, Inc., (Charles), 1815 St. Clair Avenue, Cleveland 14, Ohio
or 4700 Montrose Avenue, Chicago 41, Illinois (main)
Fine decimal equivalents chart.

Bulova Watch Company, Inc., Bulova Park, Flushing 70, New York.
"You and Time" booklet--very good.

C-Thru Ruler Company, Hartford, Connecticut
Catalog of Rulers, Protractors, etc.

Carborundum, Department B. M. D., Niagara Falls, New York
Advanced Materials on Technology.

Carborundum Company, P. O. Box 268, Perth Amboy, New Jersey.
"Super Refractories for Boiler Furnaces"
"Thermal Conductivity as a Design Tool"
"Effects of Radiation and Convection on Heat Flow"

Carborundum Metals Company, Inc., Akron, New York.
Chemical Engineering -- More Zirconium Facts.

Cast Iron Pipe Research Association, Suite 3440 Prudential Plaza, Chicago 1, Illinois. "Loss of Head Slide Rule" limited use.

Caterpillar Tractor Company, Dealer Training Division, Building H. H., Peoria, Illinois. Booklet with many practical problems and formulas. Ask for "Fundamentals of Earthmoving" #30983.

Chase Manhattan Bank, 18 Pine Street, New York 15, New York.
Checking account handbook.
"Moneys of the World"

The Chicago Bar Association, 29 South LaSalle Street, Chicago 3, Illinois.
"What Can Happen When You Buy on Time!" Pamphlet on legal facts to be considered when you make an installment purchase.

Christman, L. E., Yorkville, Illinois.
"A Rhythmic Approach to Mathematics" -- 50¢
Math Charts -- $1.50 set of 12
2 Boole Sewing Cards--with instruction--20¢

Chrysler Corporation, Detroit, Michigan
"Math Problems From Industry" Solutions and examples of math problems met in manufacturing. (Limited quantity)

Cleveland Electric Illuminating Company, 75 Public Square, Cleveland 14, Ohio.
"Electric-Calculator" -- shows relative cost of using electric appliances. Much public utility information. Also electric "rate" cards.

Cooperative Recreation Service, Inc., Radnor Road, Delaware, Ohio.
Booklets: Brain Busters and Testers -- 25¢ each -- Kit M
"Count and Capture" -- Kit X -- 25¢ or 5 for $1.00

D. Van Nostrand Company, Inc., 120 Alexander Street, Princeton, New Jersey.
"Perpetual Calendar"

Eastman Kodak Company, 343 State Road, Rochester 4, New York.
"Kodak Lenses" -- booklet 50¢. Available from Kodak dealers or Sales Service Division, Eastman Kodak Company.

Eberstadt and Company, 65 Broadway, New York 6, New York.
Booklet: 1. Chemical Fund Annual Report--December '56
2. Chemical Fund--Prospectus
Investment, Plan Application

Farm Credit Administration, Washington 25, D. C.
Booklets: "Using Credit Instruments" -- Circular #16
"The Federal Bank System" -- #35
"Publication on Farm Credit Cooperatives" -- A29.
(a charge for quantities)

Federal Reserve Bank of Minneapolis, Minneapolis, Minnesota.
"Your Money and the Federal Reserve System".

Folgelson, Ida D., 2930 N. Sheridan Road, Chicago 14, Illinois.
4 charts: "Basic Laws of Mathematics," (65¢ set) plus postage 6¢ set.

Ford Motor Company, Education Department, Dearborn, Michigan.
Chart: History of Measurement -- colored posters
A single chart (colored) "A History of Measurement"

General Electric Company, Public Relations Div., One River Road, Schenectady 5, New York.
"Engineering in Your Future" -- picture book
"Math at G. E.," "Three Ways," "Four Why's," "What Do You Think About," "Why Study Math?" "Start Planning Now For Your Career"
Large size paper prints of Robot Brains. Paper color chart of "Lamps and the Spectrum".

General Motors Corp., Educ. Relations Section of Dept. of Public Relations, 3044 West Grand Boulevard, Detroit 2, Michigan.
"Precision--A Measure of Progress," "Optics and Wheels," "Automobile Stopping Distances"

General Radio Company, West Concord, Massachusetts.
"Reactance Chart" -- useful for graphing.

Ginn and Company, 199 East Gay Street, Columbus 16, Ohio.
"Relationships of Polygons" -- 2 charts of polygons.

Good Housekeeping, 57th Street and 8th Avenue, New York 19, New York.
"Money Management--Your Budget"
"Guiding Family Spending"
"A Discussion of Family Money" and others
"Insurance"
"Budgeting Your Money"

Grumman Aircraft Engineering Corporation, Bethpage, Long Island, New York.
"Grumman Engineering"

Gurley, W. and L. E., Troy, New York.
Catalog on Instruments for the Contractor.

Hamilton Watch Company, Educational Service Department, Lancaster, Pa.
Booklet: "Telling Time"
Charts: "Time Telling and How a Watch Works" (Grades 7-12)
"The Story of Time and Timekeepers" (available in quantities)

Harcourt, Brace and World, Inc., 2126 Prairie Avenue, Chicago 16, Illinois.
"Notes for the Arithmetic Teacher" No. 13, 16-26

Heath Company, D. C., 1815 Prairie Avenue, Chicago 16, Illinois.
"Algebra on the Map" -- large chart.

Household Finance Corp., Money Management Institute, Prudential Plaza, Chicago 1, Illinois. There is available at 10¢ each or $1.00 for a set of 12 an excellent series of Money Management booklets. Also booklets on "Consumer Credit and Facts For You" "Small Loan Laws" -- single copy free, additional copies 10¢ each.

Illinois Tool Works, 2501 N. Keeler Avenue, Chicago 39, Illinois.
Trigonometry Tables and Involute Functions
"Good Formulas" -- 6 for $1.00 (minimum order of 6)

Institute of Life Insurance, 488 Madison Avenue, New York 22, New York.
A collection of teaching guides, handbooks, resource units, bibliographies, radio skits, and playlets available as aids in teaching money management and family finance. (Junior and Senior High School)

International Business Machines Corp., 590 Madison Avenue, New York 22, New York.
Booklets: "Principles of I.B.M. Accounting"
"I.B.M. Accounting," "Introduction to I.B.M.,"
"Data Processing Machines," "Light on the Future,"
"World of Numbers," "New Methods for Knowing"

I-T-E Circuit Breaker Company, 1900 Hamilton Street, Philadelphia 30, Pa.
"Conversion Factors and Formulas for Electrical Engineers"
Large chart -- excellent.

Kennametal, Inc., 4610 Beidler Road, Willoughby, Ohio.
"Kennametal Calculator"
"Kennametal Decimal Equivalent Card"

Kenworthy Educational Service, Inc., 138 Allen Street, Buffalo 1, New York.
"Reference Guide to Better Tested and Approved Teaching Aids" -- a list of materials and prices.

Keuffel and Esser Company, Adams and Third Street, Hoboken, New Jersey.
Good booklets: "Solar Ephemeris and Surveying Instrument Manual," "How to Choose a Pocket Slide Rule," "Slide Rule? May I Help--" "Graph Sheets" "Elementary Instructions for Operating the Slide Rule"

Kidd, K. P., University of Florida, Gainesville, Florida.
Manual for Construction and Use of Slide Rule
Sample slide rule kit
Additional kits (25¢)

Litton Industries, Advertising and Public Relations Dept., 336 N. Foothill Road, Beverly Hills, California.
"Problematical Recreations" -- Senior High
"More Problematical Recreations"

Lowe and Campbell, 1272 West Third Street, Cleveland 14, Ohio.
"Field and Court Diagrams" -- Good for measurement and scale drawing.

Lufkin Rule Company, 1730 Hess Avenue, Saginaw, Michigan.
Pamphlets: "Micrometer Reading Made Easy," "The Amazing Story of Measurement" (10¢ and worth it)
A plastic circular rule. A plastic decimal equivalent ruler. Large charts explaining types of precision tools, decimal equivalents.
"How to Use a Micrometer" "Time Savers"

MacGregor Company, 4861 Spring Grove Avenue, Cincinnati 32, Ohio.
A large field and dimension chart.

Machinery's (Decimal Equivalents and 12 Useful Data Sheets)
49 Questions and Answers for Shop Men, Designers, Engineers
Industrial Press Company - Publishers of Machinery
93 Worth Street, New York 13, New York

Massachusetts Mutual Life Insurance Company, Springfield 1, Massachusetts.
Chart: "Prepare for a Career in Life Insurance Mathematics"

The Mathematical Association of America, University of Buffalo, Buffalo 14, New York.
Booklet: "Professional Opportunities in Mathematics" 25¢ for single copy and 20¢ each for orders of 5 or more.

Merrill Lynch, Pierce, Fenner and Smith, 216 Superior Avenue, Cleveland 13, Ohio.
Booklets: "How to Invest," "How to Read a Financial Report,"
"What Everyone Ought to Know About This Stock and Bond Business"

Metropolitan Life Insurance Company, One Madison Avenue, New York 10, New York.
Pamphlets: "Statistical Bulletins Record Low Mortality in 1953"
Booklet: "Mental Disorders in the U. S." -- excellent graphs.

Micrometrical Mfg. Company, P. O. Box 1067, Ann Arbor, Michigan.
Bulletins in Profilometer and "You Can't Always Believe Your Senses"

Monroe Calculating Machine Company, Orange, New Jersey.
Booklets: "Teachers Guide for Educator" -- explains Monroe Adding Calculator.
"Can Children Really Enjoy Arithmetic?" -- explains use of hand-operated calculating machines in learning arithmetic.
"The Eternal Quest for Time"
Table of decimal equivalents

National Association of Manufacturers, 2 East 48 Street, New York 17, New York.
A list of teaching aids--some are adaptable. Industry--education kit.

National Aviation Education Council, 1025 Connecticut Avenue, N. W., Washington 6, D. C.
"Mathematics Teaching Aids for a Stronger America" (75¢ plus postage)
"Arithmetic of Flying" (50¢) (For Junior High)
Pictures, pamphlets, and packets for air space age education.
For air/space-minded teachers--Fact Sheet "Skylights" (monthly) (Get on mailing list)

National Cash Register Company, Main and K Streets, Dayton 9, Ohio.
Booklets dealing with adding machines and machine accounting.

National Industrial Conference Board, 460 Park Avenue, New York 22, New York.
"Road Maps of Industry"

National Research Bureau, Inc., 424 North Third Street, Burlington, Iowa.
Pamphlets: "Educational Aids for Schools and Colleges"
"Did You Know?" Series #1 -- much percentage
"Know What You Pay for Credit" -- interest.

New Jersey Credit Union League, P. O. Box 298, Heightstown, New Jersey.
Pamphlet: "What Can the Credit Union Do For Me"
Other pamphlets available.

New York Air Brake Company, Watertown Division, Starbuck Avenue, Watertown, New York.
"Hydraulic Formulas" -- a useful sheet for algebra.

New York Clearing House, 77 Cedar Street, New York 5, New York.
Pamphlet: "Information Regarding the Operation of the New York Clearing House"

New York Life Insurance Company, 51 Madison Avenue, New York 10, New York.
Pamphlet: "Should You Be a Mathematician?"

New York Stock Exchange, 11 Wall Street, New York 5, New York.
"You and the Investment World" -- a series of good pamphlets.

Ohmite Manufacturing Company, 3601 Howard Street, Skoie, Illinois.
Capacitor Calculator (cardboard) 25¢
Little Devil Color Coder 8¢

Optical Gaging Products, Inc., 26 Forbes Street, Rochester 11, New York.
Catalog #9 on charts and gages. Much material good for teaching measurement in senior high.
#10 Optical Projection -- the key to improving gaging technique.

Paragon Electric Company, Two Rivers, Wisconsin
Time - Past, Present and Future (32-page picture booklet 25¢)

Public Affairs Committee, Inc., 22 East 38 Street, New York 16, New York.
A series of pamphlets at 25¢ each. Less in quantity orders.
"Footing the Hospital Bill" #222
"When You Invest, etc." #221

Remington Rand Univac, Remington Rand Division of Sperry Rand Corporation,
2115 Chester Avenue, Cleveland 14, Ohio.
Univac Educational Series
#1 "How the Computing System Works For You"
#2 "Programming a New Profession For You"

Row, Peterson and Company, 1911 Ridge Avenue, Evanston, Illinois.
"Growing to Understand Measurement" #83
"Understanding Arithmetic in the Primary Grades"
"Methods for Improving Problem Solving in Arithmetic" Grades 1-8
Monographs 72, 94, 99

Scott, Foresman and Company, 433 East Erie Street, Chicago 11, Illinois.
Number Lines -- new large chart. Ask for enough for teachers in your school mathematics department.

Scripta Mathematica, Yeshiva University, Amsterdam Avenue 186 Street,
New York 33, New York.
Pictures and background material of famous mathematicians and geometric designs. Many interesting articles, pamphlets, and books. A list of materials and prices is available.

"Signal Corps Posters"
National Council of Teachers of Mathematics, 1201 Sixteenth Street, N. W.,
Washington 6, D. C.
Twenty posters showing applications in radio and communications, 40¢ a set.

Smith-Corona Marchant, Inc., 410 Park Avenue, New York 22, New York.
Large chart showing controls and keyboard of rotary calculations.
Plastic rulers with inches divided into different subdivisions.
Booklet: "From Og to Googol".

Society of Actuaries, 208 South LaSalle Street, Chicago 4, Illinois.
"Actuaries Examinations"
Society of Actuaries -- requirements for admission.

Texaco Waterways Service, 135 East 42 Street, New York 17, New York.
Texaco Cruising Chart and Kit.

Travelers Insurance Company, 700 Main Street, Hartford 15. Connecticut.
Safety driving cartoons (gives statistics)

United Aircraft Corporation, 400 Main Street, E., Hartford 8, Connecticut.
"The Age of Flight" - pamphlet with pictures of aircraft.

United States Department of Agriculture, Forest Service, Washington 25, D. C.
"Ranger 'Rithmetic" for 6th and 7th grades
"Fact Sheets"
"Look to Your Timber, America"

United States Department of Labor, Bureau of Statistics, Superintendent of Documents, Washington 2, D. C.
"Mathematics and Your Career" Revised 1960
"Mathematicians, Statisticians, and Programmers" Bulletin #1255-46 10¢

United States Government Printing Office, Department of Public Documents, Washington, D. C.
Pamphlet: C-13:10:232 50¢

United States Government Printing Office, Superintendent of Documents, Washington 25, D. C.
"Employment Opportunities for Women Mathematicians and Statisticians" Bulletin 262 of Women's Bureau 25¢
"Is Math In The Stars For You?" 5¢

United States Savings and Bonds Division Office, Treasury Department, 416 New Post Office Building, Columbus 15, Ohio.
Booklet: "Teaching Thrift Through School Savings"

United States Steel Corp., 614 Superior Avenue, Cleveland 13, Ohio.
"Catalog of USS American Nails" -- shows use of fractions (in class quantities)
"Manual of Carpentry" -- good for geometry, depreciation, board measure - to teachers only.
Chart: "Man in the Middle" -- bibliography

United States Treasury Department, Internal Revenue Service, Washington 25, D. C.
Sample income tax returns in enlarged and reduced sizes with directions.

University of Tennessee, Knoxville College of Education, Department of Curriculum and Instruction, Knoxville, Tennessee.
List of Mathematics Filmstrips
I Arithmetic
II General Mathematics
III Algebra
IV Geometry
V Calculus

Victor Adding Machine Company, 3900 N. Rockwell Street, Chicago 18, Illinois.
Limited amount of material on operation of their computing machines.

Wagner Electric Corporation, 6400 Plymouth Avenue, St. Louis 14, Missouri.
"Alternating Current Simply Explained" -- good pamphlet available in reasonable quantities.

Wheat Flour Institute, 309 W. Jackson Boulevard, Chicago 6, Illinois.
Booklet: "Weight Control the Module Way"

Winston, John C. Company, 1010 Arch Street, Philadelphia 7, Pennsylvania.
"Square Yard" -- chart

World Calendar, P. O. Box 224, Lenox Hill Station, New York 21, New York.
Booklet: "The World Calendar"

Yoder Instruments, East Palestine, Ohio.
Catalog: "Visual Aids and Instruments Make Math Interesting"

APPENDIX III

FILMS AND FILM STRIPS

September, 1961

Junior and Senior High Mathematics Sound Films and Film Strips

The film titles listed below may be borrowed by Cleveland Public School teachers from the Bureau of Visual Education. For further information, see the teacher in charge of visual education at your school.

Sound Films

A Plus B Squared
Angles
Angles and Arcs in Circle
Areas
Assignment - Weights and Measures
Careers in Mathematics
Celestial Navigation I, II, III
Chords and Tangents of Circles
The Circle
Congruent Figures
Day at the Federal Reserve Bank of Cleve.
Decimal Fractions
Decimals Are Easy
Donald in Mathemagicland
#Fractions: Finding the Common Denominator
Geometry and You
How Banks Serve
How Man Learned to Count
How to Add Fractions
How to Change Fractions
How to Divide Fractions
How to Multiply Fractions
How to Subtract Fractions
How to Use Your Bank
How's Chances (Probability and Statistics)
Introduction to Fractions
It's All Arranged (Permutations and Combinations)
Language of Graphs
Lines and Angles
Locus
#Mathematician and the River
Meaning of Percentage
Meaning of Pi
#Measuring Areas: Squares, Rectangles
Measurement
Micrometer
Money Talks
Motivating the Class
Mysterious "X" (Algebra)
Parallel Lines
Patterns for Mathematics
Pay to the Order of
Percentage
Principles of Scale Drawing
Properties of Triangles
Property Taxation
Quadrilaterals
Quicker Than You Think (Digital Computer)
Similar Triangles
Sine Language (Trigonometry)
Slide Rule: Percentage, Proportion, Squares, and Square Roots
Steel Rule
Story of our Money System
Story of our Number System
Story of Weights and Measures
Stretching the Imagination (Topology)
#Surface Areas of Solids (I and II)
Time
United States Treasury
Using the Bank
Using Bank Credit
Vernier Scale #4
#Volume and Its Measurement
Volumes of Cubes, Prisms, and Cylinders
Volumes of Pyramids, Cones, and Spheres
Weights and Measures
What are Fractions
What's the Angle (Geometry)
Work of the Stock Exchange
Your Family Budget
Your Thrift Habits

#Available in 1962

Film Strips

Fractions (Set of 4)

19F1	How to Add Fractions
19F2	How to Change Fractions
19F3	How to Subtract Fractions
19F4	Introduction to Fractions

History of Measures (Set of 6)

8H1	Area Measures
8H2	History of our Calendar
8H3	History of Weight and Volume
8H4	History of Linear Measures
8H5	History of our Number System
8H6	History of Telling Time

Light on Mathematics - Arithmetic (Set of 8)

13L1	Five Keys to Math
13L2	Addition and Subtraction
13L3	Multiplication and Division
13L4	Fractions, Decimals, and Percentage
13L5	Addition and Subtraction of Fractions
13L6	Multiplication and Division of Fractions
13L7	Square Root and Cube Root
13L8	Order of Operations

Light on Mathematics - Geometry (Set of 7)

13L9	Addition and Subtraction in Geometry
13L10	Multiplication and Division in Geometry
13L11	Angular Measurement
13L12	Constructions
13L13	Scales and Models
13L14	Vectors
13L15	Trigonometry

Light on Mathematics - Algebra (Set of 6)

13L16	Positive and Negative Numbers
13L17	Ratios and Proportions
13L18	Exponents and Logarithms
13L19	The Arithmetic of Algebra
13L20	Equations and Formulas
13L21	Problem Analysis

Light on Mathematics - Graphs (Set of 3)

13L22	Graph Uses
13L23	Plotting Graphs
13L24	Analytic Geometry

Plane Geometry (Set of 16)

11P1	Introduction
11P2	Vocabulary - Lines and Angles - Part I
11P3	Vocabulary - Lines and Angles - Part II
11P4	Vocabulary - Line Relationships
11P5	Vocabulary - Triangles
11P6	Vocabulary - Polygons
11P7	Vocabulary - Circles - Part I
11P8	Vocabulary - Circles - Part II
11P9	Postulates - Lines
11P10	Postulates - Triangles - Circles
11P11	Locus
11P12	Geometry in Art
11P13	Logic - Definitions
11P14	Logic - Deductive Reasoning
11P15	Logic - Induction
11P16	Logic - Mistakes in Thinking

Study of Fractions (Set of 11)

25S1	Units and Fractional Parts
25S2	Multiple Fractions, Numerator and Denominator
25S3	Comparing Fractions, Adding and Subtracting
25S4	Multiple Fractions, Improper Fractions
25S5	Improper Fractions (Cont'd.)
25S6	Reducing and Changing Fractions
25S7	Changing Fractions to a Common Denominator - Part I
25S8	Changing Fractions to a Common Denominator - Part II
25S9	Multiplying Fractions
25S10	Dividing Fractions
25S11	Reciprocals - The Rule of Division

Decimals and Measurements (Set of 7)

4U1	Meaning and Reading of Decimals
4U2	Addition and Subtraction of Decimals
4U3	Multiplication of Decimals
4U4	Division of Decimals
4U5	Changing Fractions to Decimals - Decimals to Fractions
4U6	Advancing in Linear Measurements
4U7	Advancing in Quantity Measurements

#Per Cents and Percentage Applications (Set of 7)

Meaning and Understanding of Per Cent
Buying and Selling - Applications of Per Cent
Commission - Meaning and Application
Interest - Borrowing and Investing
Insurance
State and Local Taxes
Federal Taxes

#Available in 1962

APPENDIX IV

ROOM AND EQUIPMENT

ROOM AND EQUIPMENT

It is not always necessary to build a completely new room to have a laboratory type mathematics classroom. Many times a little imagination, some new equipment, and colorful paint will transform the traditional classroom into a modern one.

The first big step is to replace the fixed seating arrangement with individual chairs and table-type desks. These should be sturdy enough to withstand considerable moving about yet light enough to be moved easily. This should produce a flexibility in seating patterns for various activities.

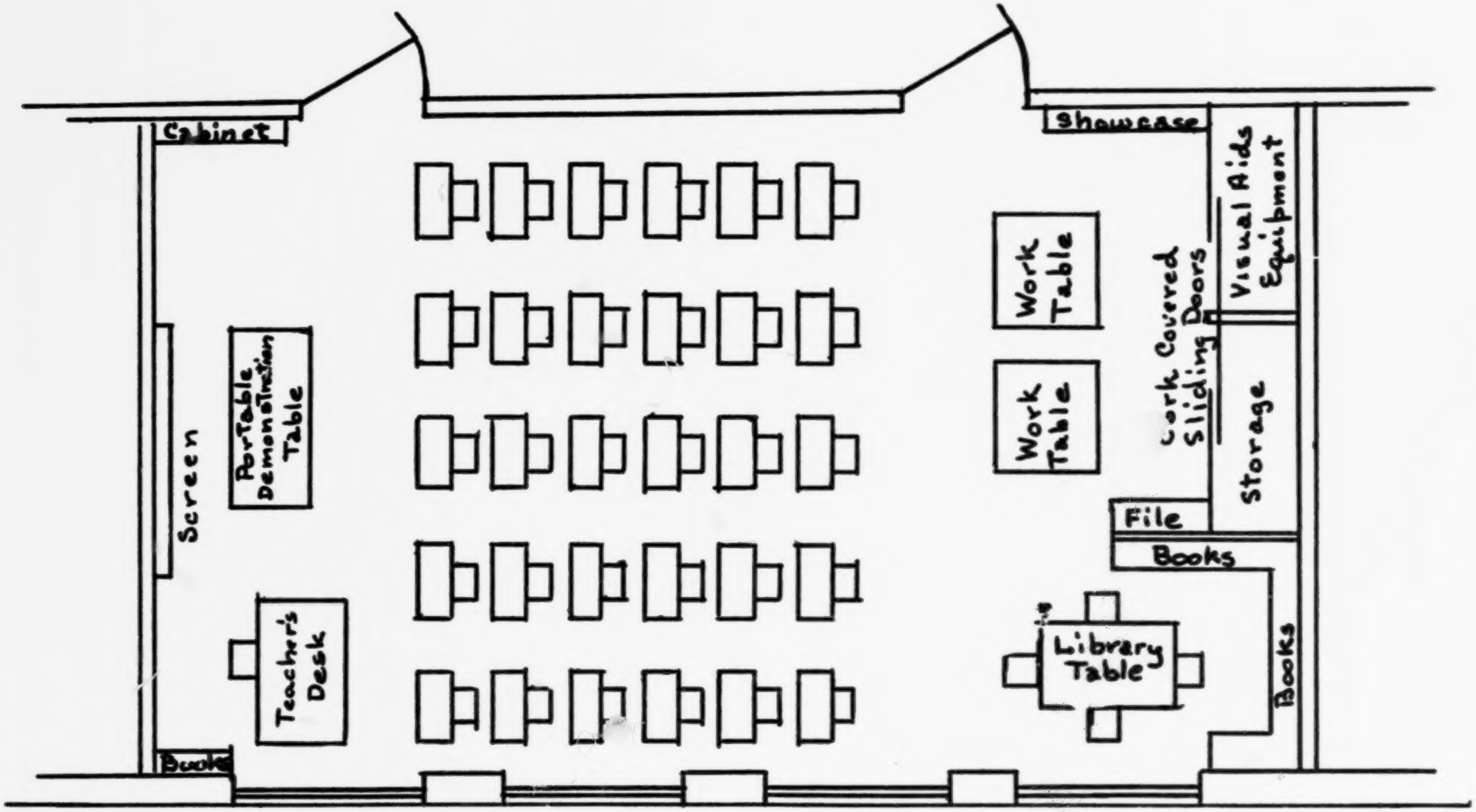
A portable demonstration desk should also be provided to fit into this idea of flexible seating patterns. This desk should be the type that has a built-in water tank, pump, models, and other supplies.

Another important feature is a pupils' library corner. A mathematics reference library is practically mandatory in a laboratory type classroom.

Adequate storage space for visual aids projectors, films, and pupils' projects is most essential.

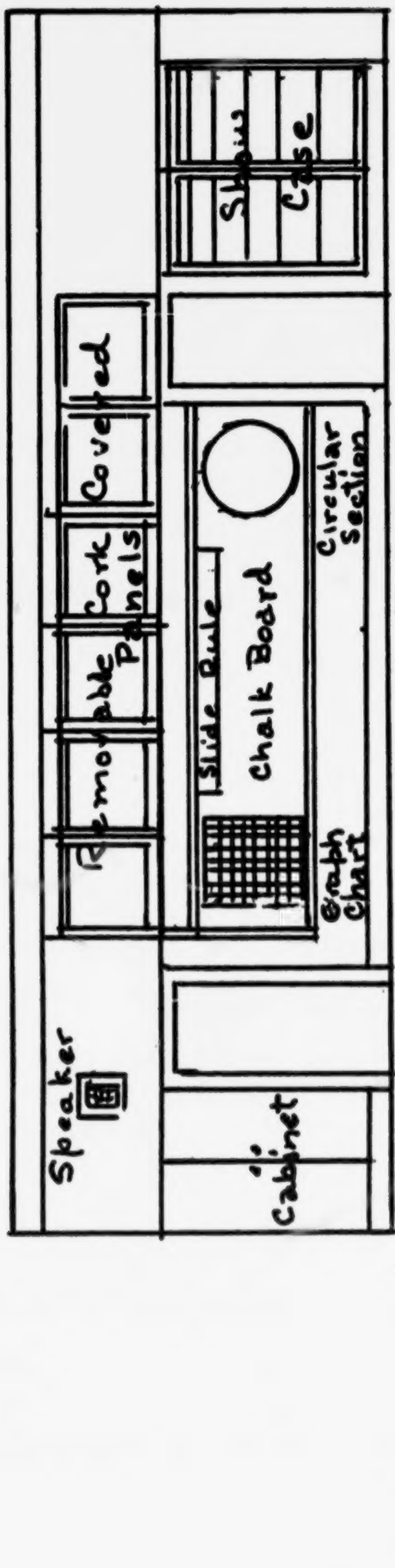
Enthusiasm for pupils' projects is generated by public display. Thus, a good display case and much bulletin board space should be available. One of the easiest and most useful methods of providing bulletin space is through the use of light weight portable bulletin boards. If hooks are permanently located on the walls and large matching eyelets are set into the boards, a quick exchange may be made. This would make it possible to prepare the displays at one's convenience prior to exhibiting them.

The plan on the succeeding page is set up with the foregoing thoughts in mind and could well fit into a classroom of 25 x 36 feet.

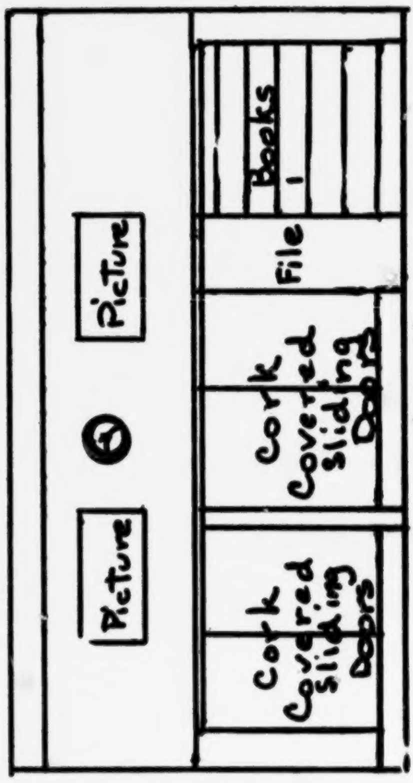

Cabinet
Screen
Portable Demonstration Table
Teacher's Desk
Books
Showcase
Work Table
Work Table
Cork Covered Sliding Doors
Visual Aids Equipment
Storage
File
Books
Library Table
Books

Mathematics Laboratory Room

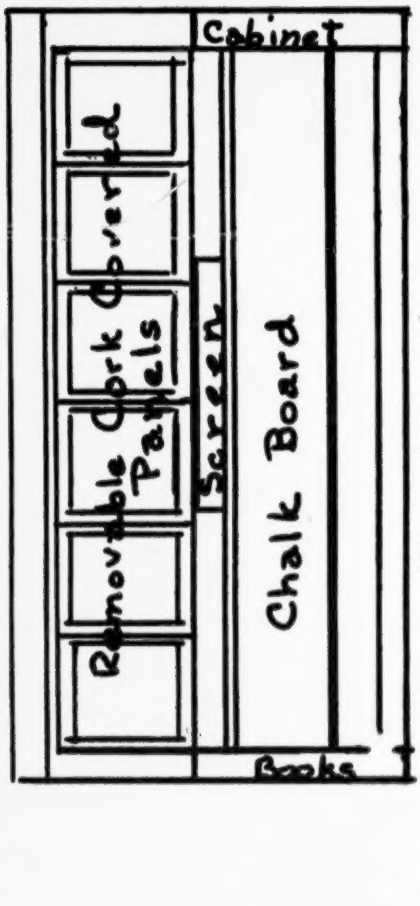
James A. Clement
Martin H. Preuss


Speaker
Cabinet
Removable Cork Covered Panels
Slide Rule
Chalk Board
Graph Chart
Circular Section
Show Case

Side Wall


Picture
Picture
Cork Covered Sliding Doors
Cork Covered Sliding Doors
File
Books

Rear Wall


Cabinet
Removable Cork Covered Panels
Screen
Chalk Board
Books

Front Wall

The following equipment was listed in the replies to a questionnaire given to teachers of experimental mathematics classes as being desirable adjuncts to a laboratory type classroom.

abacus
angle mirror
angle trisector
area-perimeter board

balance and weights
BB shot
blocks (cubes)
"Burns Boards"

calendars of various kinds
calipers
chalk holder (Hand-Gienic)
chalkboard drawing set
charts of various kinds
clocks of various types
computer
construction kits
construction paper
coordinate paper
coordinate stamp
curtains or drapes

decimal and conversion chart
demonstration table
depth gauge
desk calculators
drawing boards and instruments
duplicator

extensible triangle
extensible quadrilateral
electrical outlets (sufficient)

film library
film strips
flannel board
flooring (tile or linoleum)
fluorescent lighting
foot candle meter
fraction chart
french curves

games and puzzles
geometry ruler ("Speed Up")

hollow measuring solids

inclined plane and cart

Johannsen blocks

kaleidoscope

library - professional and student

magazines and racks
Magic Marker (ink)
magnetic board
maps
mathematical models of all kinds
measuring tapes
meter stick
micrometers
motor (electric) and grinding wheels

oscilloscope
odometer

parallel rulers
pendulum
pictures of mathematicians
place value charts
plane table
planimeter
probability board and supplies
projector - 16mm
projector, slide and film strip
projector - overhead
protractor - individual
pulleys

radio - AM - FM

Schacht instruments
sextant
slated globe
slide rules
"Space Geometrics Laboratory"

stencil circle chart
stencil graph chart
string
student journals

tape recorder and technical tapes
teaching machines
television set
transit and level
triangles (draftsman)
typewriter (math keyboard)

wheel and axle set

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